lake winnipeg, churchill & nelson rivers study board CANADA MANITOBA 1971-'75

background documents and interim reports

technical
report
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LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

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CANADA-MANITOBA STUDY AGREEMENT
FOR LAKE WINNIPEG AND THE
CHURCHILL AND NELSON RIVERS

August, 1971

CANADA-MANITOBA STUDY AGREEMENT FOR
LAKE WINNIPEG AND THE CHURCHILL AND NELSON RIVERS

THIS AGREEMENT made as of the 24th day of August, 1971.

BETWEEN THE GOVERNMENT OF CANADA,
represented herein by the
Minister of the Environment
(hereinafter called "Canada")

OF THE FIRST PART

AND THE GOVERNMENT OF THE PROVINCE
OF MANITOBA
represented herein by the
Minister of Mines, Resources
and Environmental Management
(hereinafter called "Manitoba")

OF THE SECOND PART

WHEREAS the Governments of Canada and Manitoba entered into agreements in 1963 and 1964 for joint studies of the power potential and development program for the Nelson River; and

WHEREAS the two Governments entered into a further agreement in 1966, based on the recommendation of the foregoing studies, that construction of the facilities necessary to give effect to the development of the hydro-electric potential of the Nelson River should forthwith be undertaken; and

WHEREAS the electricity generating facilities which the Province undertook to construct under the aforesaid agreement of 1966 included the generating station at the Kettle Rapids site on the Nelson River; works necessary to divert water from the Churchill River to the Nelson River; and works located in the vicinity of the outlet of Lake Winnipeg, which works will be designed to permit the levels of the water of Lake Winnipeg and the outflow to the Nelson River to be regulated and controlled; and

WHEREAS Manitoba Hydro has now installed three of the twelve units ultimately proposed for the Kettle Station and has designed the control works for the outlet of Lake Winnipeg; and

WHEREAS the Government of Manitoba has issued a license to permit Manitoba Hydro to proceed with the construction of the facilities at the outlet of Lake Winnipeg which will be completed in time to meet the electrical energy requirements foreseen for the winter of 1974/75; and

WHEREAS plans have been announced by Manitoba Hydro with the conditional approval of the Government of Manitoba to increase the energy output of generating plants on the Nelson River, commencing in the winter of 1975/76, by diverting flows from the Churchill River at Southern Indian Lake of up to a maximum of 30,000 cubic feet per second provided that the lake is not raised above the 850 foot level; and

WHEREAS the Governments of Canada and Manitoba recognize the increasing need for co-ordinating their efforts and for considering the effects on all interests in water resources planning; and

WHEREAS the social and economic welfare of the people of Manitoba depends to a large degree on the way in which the waters of Lake Winnipeg and the Churchill and Nelson Rivers are managed for energy, water supply, fisheries, wildlife, recreation and transportation; and

WHEREAS the Governments are jointly concerned that these projects achieve the greatest overall benefit possible without unduly prejudicing the present or potential development of these water bodies for other resource uses and users; and

WHEREAS His Excellency, the Governor General-in-Council by Order-in-Council P.C. 1971-1776 has authorized the Minister of the Environment to execute this Agreement on behalf of Canada; and

WHEREAS His Honour, the Lieutenant Governor-in-Council by Order-in-Council 757/71 has authorized the Minister of Mines, Resources and Environmental Management to execute this Agreement on behalf of Manitoba;

NOW THEREFORE THIS AGREEMENT WITNESSETH THAT in consideration of the premises, covenants and agreements herein contained the parties covenant and agree with each other as follows:

1. OBJECTIVE

The purpose of the studies authorized under this Agreement is to determine the effects that regulation of Lake Winnipeg, diversion from the Churchill River and development of hydro-electric potential of the Churchill River diversion route are likely to have on other water and related resource uses and to make recommendations for enhancing the overall benefits with due consideration for the protection of the environment.

2. TERMS OF REFERENCE

The study of probable effects of Manitoba Hydro's projects must be sufficiently broad so as to include all important effects on the water regime and on related resource uses and it must be adapted to provide reliable data on present natural conditions and the anticipated and actual conditions arising from the operation of the controls and diversion as designed and constructed. Recommendations will be made consistent with the stated objective of the study. Canada and Manitoba agree to give priority to those studies which may lead to recommendations for modifications or additions to the works, or operation of the works, that may be under construction, approved or proposed. Although there will be no imposed change in regime for at least the next three years, early attention will also be directed to studies which will establish and measure the parameters that define the state of nature conditions for the lakes and rivers involved. Consequently, the program will include studies of:

(a) EFFECTS ON THE WATER REGIME

(i) Water Levels and Flows - as required to determine what changes in the existing regime can be expected to result from the operation of proposed storage and diversion works on the Churchill, Rat-Burntwood and Nelson systems, including the timing, range and frequency of fluctuations in lake levels and stream flows. Certain information will be taken as given, namely that Lake Winnipeg will be regulated between the levels of 711 and 715 feet elevation and that Southern Indian Lake will be raised to not more than 850 feet elevation for a diversion out of the Churchill River of up to 30,000 cubic feet per second. In the event that the Government of Manitoba advises that a lower level will be utilized or that an alternative or additional diversion will be used, the foregoing information will be modified accordingly.

(ii) Erosion and Sedimentation - as required to estimate changes in channel and bank morphology of both donor and receiving streams below points of diversion, and in shoreline erosion and sediment movement patterns in the larger lakes affected by regulation.

(iii) Water Quality - as required to measure existing quality and estimate changes likely to occur to water quality in storage reservoirs and in reaches downstream therefrom.

(b) EFFECTS ON THE USES OF WATER AND RELATED RESOURCES

(i) Community Supply - as required to estimate the effects of regime changes on the quantity and quality of water available for domestic, municipal and industrial use, including particularly that for the Town of Churchill; and to project any resulting benefits and any costs necessary to secure them, or for remedial measures.

(ii) Fisheries and Limnology - as required to provide an assessment of changes to be expected in the fisheries and aquatic ecosystems; to project benefits and costs for the fishery.

(iii) Wildlife - as required to assess probable changes in wildlife populations and habitats; to project benefits and costs to wildlife management and use expected from water level and flow changes.

(iv) Recreation and Tourism - as required to assess the impact of water regime changes on existing and potential tourism and recreational activities, including cottage development, sport fishing, boating and swimming; and to consider the benefits and costs of developing such additional recreation opportunities as may be facilitated by the proposed developments.

(v) Navigation - as required to assess the impact of water regime changes on existing and potential navigation; the effect of increased accessibility through Lake Kiskittogisu to Cross Lake and the effect of the reduction of fresh water ice on Churchill Harbour; and to integrate the studies herein described with those presently being carried out separately under the federal Navigable Waters Protection Act.

(vi) Forestry and Land Use - as required to inventory and evaluate the forested areas which will be flooded or made more or less accessible by proposed water development; and to examine the probable effect of depositing spoil from dredging operations on the specified muskeg or land surfaces adjacent to the excavated channels and suggest the ultimate use of land so affected, including the steps necessary, if any, for its improvement.

(vii) Mining - as required for acceleration of geologic mapping and exploration of potential mining areas along the Churchill River diversion route which are designated for flooding and to estimate the effects of changed access.

(viii) Archaeological and Historical Sites - as required to identify and determine significance of such sites in areas which are designated for flooding.

(c) SOCIAL IMPLICATIONS

(i) Project Impact - as required to assess the local impact in social and economic terms of the works, including the effects on employment, wage rates, transient population, trade, accessibility, mobility and communications; to consider and propose means of ameliorating any undesirable effects on the people of the communities in the area.

(ii) Potential Opportunities - as required to determine means by which the people of the region can, in both the short and long term, obtain the greatest advantage from the social and economic opportunities resulting from construction of the works and associated developments.

3. ADMINISTRATIVE ARRANGEMENT FOR JOINT PLANNING

Canada and Manitoba shall participate in a process of joint planning. To facilitate this process in the time available, the following shall be established:

A LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD to consist of six members of whom three will be appointed by Canada and three by Manitoba. The Study Board will be responsible for the study, will meet as required and will report to the Minister of the Environment of Canada and the Minister of Mines, Resources and Environmental Management of Manitoba. Chairmanship of the Study Board will rotate on an annual basis between federal and provincial members, as chosen by the members; with the first chairman being a provincial member. The Study Board will appoint a full-time Study Director and a Technical Advisory Committee of two members from each government to assist the Study Director. Under the direction of the Study Board, the Manitoba Department of Mines, Resources and Environmental Management will manage the program described herein and may employ the services of private consultants and firms as well as those of the agencies of the two governments.

4. FINANCING

(a) Costs of the study shall be borne as follows: Canada 50 per cent, Manitoba 50 per cent, including, but not limited to administration, the cost of collection and analysis of data, field surveys and the cost of consultants engaged as part of the program. Salaries and related costs of federal and provincial civil servants engaged in the program shall not be paid from funds approved under this Agreement excepting staff specifically assigned to or engaged in studies under this Agreement.

(b) Subject to the terms and conditions of this Agreement and subject to the funds being voted by Parliament, the aggregate sum to which Canada shall be liable in respect of this Agreement is not to exceed $1,000,000.

(c) Subject to the terms and conditions of this Agreement and subject to the funds being voted by the Legislative Assembly, the aggregate sum to which Manitoba shall be liable in respect of this Agreement is not to exceed $1,000,000.

(d) This Agreement shall become binding on the date executed. Costs incurred prior to January 1st, 1971 shall not be eligible for sharing under this Agreement. This Agreement shall terminate on December 31st, 1974, or at such earlier date as may be agreed upon by the parties hereto, but claims for costs incurred may be made up to December 31st, 1975.

(e) Each party shall keep complete records of all expenditures made severally pursuant to this Agreement and shall support such expenditures with proper documentation. Canada and Manitoba upon request shall make these records and documents available to auditors appointed by each other.

(f) Manitoba shall assume responsibility for the funding of this Agreement. The financial arrangements shall be established by the Study Board.

5. REPORTS AND RECOMMENDATIONS

(a) Specific reports or recommendations with documentation shall be submitted to the Ministers and to Manitoba Hydro at any time, as the progress of the studies reveals information or leads to proposals that may be relevant to the design or construction of works that may be proposed or in progress. The first such report to be submitted no later than December 31st, 1971 and subsequent reports not less than annually. A final report will be submitted on or before December 31st, 1974.

(b) The final report will include recommendations for such further measurements, sampling or investigations as may be desirable to provide at a later date an accurate record of the before and after effects of the works involved. An estimate of the cost of such further studies will be included.

6. GENERAL

(a) Canada and Manitoba shall exchange copies of all reports and related available information from prior and current studies for use in the program.

(b) This Agreement shall not be construed to vest in Canada any proprietary interests in projects constructed or modified hereunder.

(c) This Agreement may from time to time be reviewed by the parties hereto and, with the approval of the Governor-in-Council and the Lieutenant Governor-in-Council, may be revised.

(d) No member of the Parliament of Canada or the Legislative Assembly of Manitoba shall hold, enjoy or be admitted to any share or part of any contract, agreement, commission or benefit arising out of this Agreement.

(e) The Study Board may recommend to both parties joint participation in detailed studies over and above that which is called for in this Agreement, including the extension of the Agreement to cover studies recommended in the final report.

IN WITNESS WHEREOF the Honourable Jack Davis, Minister of the Environment has hereunto set his hand on behalf of Canada and the Honourable Sidney Green, Minister of Mines, Resources and Environmental Management, for Manitoba.

In the Presence of	Signed on behalf of Canada	
"John Mullally"	"Jack Davis"	"Aug. 24, 1971" Date
In the Presence of	Signed on behalf of Manitoba	
"T. E. Weber"	"Sidney Green"	"Sept. 9, 1971" Date

APPENDIX 1 - B

AMENDMENT TO THE
CANADA-MANITOBA STUDY AGREEMENT
FOR LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS STUDY

AMENDMENT TO THE
CANADA-MANITOBA STUDY AGREEMENT
FOR LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS STUDY

March, 1975

SCHEDULE "A"

AMENDMENT TO THE
CANADA-MANITOBA STUDY AGREEMENT FOR
LAKE WINNIPEG AND THE CHURCHILL AND NELSON RIVERS

THIS AGREEMENT made as of the day of , 1975.

BETWEEN

THE GOVERNMENT OF CANADA,
represented herein by the
Minister of the Environment
(hereinafter called "Canada")

OF THE FIRST PART

AND

THE GOVERNMENT OF THE
PROVINCE OF MANITOBA,
represented herein by the
Minister of Mines, Resources
and Environmental Management
(hereinafter called "Manitoba")

OF THE SECOND PART

WHEREAS Canada and Manitoba entered into a Study Agreement dated the 24th day of August, 1971, to determine the effects that regulation of Lake Winnipeg, diversion from the Churchill River and development of hydroelectric potential of the Churchill River diversion route are likely to have on other water and related resource uses and to make recommendations for enhancing the overall benefits with due consideration for the protection of the environment;

AND WHEREAS the Study Board established under the existing Agreement, is to submit a final report on or before December 31, 1974;

AND WHEREAS the Study Board has decided to prepare two final reports: a Summary Report and a Technical Report;

AND WHEREAS the Study Board has reassessed the time required to prepare and distribute the two reports and has recommended that the termination date for the existing Agreement be revised to April 30, 1975;

AND WHEREAS the Governor-General-in-Council by Order-in-Council P.C. 1975-3/3 of the 16th day of January, 1975, has authorized the Minister of the Environment to amend this Agreement on behalf of Canada;

AND WHEREAS the Lieutenant-Governor-in-Council by Order-in-Council No. 1592/74 of the 4th day of December, 1974, has authorized the Minister of Mines, Resources and Environmental Management of Manitoba to amend this Agreement on behalf of Manitoba.

NOW THEREFORE THIS AGREEMENT WITNESSETH that the parties hereto mutually agree as follows:

1. Section 4(d) is amended by deleting the termination date of "December 31, 1974", in the fourth line and substituting therefor the date of "April 30, 1975".
2. Section 5(a) is amended by deleting the submission date for the final report of "December 31, 1974", in the eighth line and substituting therefor the date of "April 30, 1975".

IN WITNESS WHEREOF the Honourable Jeanne Sauvé, Minister of the Environment, has hereunto set her hand on behalf of Canada and the Honourable Sidney Green, Minister of Mines, Resources and Environmental Management, has hereunto set his hand for Manitoba.

In the presence of

Signed on behalf of Canada

Jeanne Sauve

March 6, 1975
Date

In the presence of

Signed on behalf of Manitoba

February 14/75
Date

APPENDIX 1 - C

INTERIM LICENSE FOR THE
REGULATION OF WATER LEVELS FOR
WATER POWER PURPOSES -
LAKES WINNIPEG, PLAYGREEN AND KISKITTOGISU

INTERIM LICENSE FOR THE REGULATION OF WATER LEVELS FOR WATER POWER PURPOSES - LAKES WINNIPEG, PLAYGREEN AND KISKITTOGISU

issued by

Manitoba Department of Mines, Resources and Environmental Management
Winnipeg, Manitoba
November, 1970

ACCEPTANCE OF INTERIM LICENSE

Manitoba Hydro hereby accepts the Interim License authorizing the regulation of the water levels of Lakes Winnipeg, Playgreen, and Kiskittogisu for the development of water power, a copy of which Interim License is attached hereto and marked Exhibit "A", and hereby undertakes to observe and fulfill all conditions which the Licensee is required to observe and fulfill under said Interim License and under The Manitoba Water Power Regulations, being Manitoba Regulation 95/45, and all amendments thereto.

The aforesaid acceptance and undertaking shall bind Manitoba Hydro, its successors and assigns.

IN WITNESS WHEREOF the corporate seal of Manitoba Hydro is hereby affixed, attested by the hands of its proper officers in that behalf at Winnipeg, in Manitoba, this 23rd day of November, 1970.

MANITOBA HYDRO

Per: David Cass-Beggs
Chairman

Secretary

PROVINCE OF MANITOBA

DEPARTMENT OF MINES AND NATURAL RESOURCES

WATER RESOURCES BRANCH

INTERIM LICENSE FOR THE REGULATION OF WATER LEVELS FOR WATER POWER PURPOSES

Lakes Winnipeg, Playgreen, and Kiskittogisu

Issued in accordance with the provisions of the Water Power Act, Chapter W70, Revised Statutes of Manitoba, 1970, and amendments, and of the Regulations in force thereunder to govern the mode of granting and administering Provincial water-power rights.

WHEREAS Manitoba Hydro, a corporation duly incorporated by Act of the legislature of the Province of Manitoba, and whose head office address is Box 815, Winnipeg 1, Manitoba, (hereinafter called "the Licensee"), by letter dated September 22, 1970, signed by David Cass-Beggs, Chairman, and by other documents attached hereto, has filed with the Director of Water Resources at Winnipeg, (hereinafter called "the Director"), an application for a license to regulate the water levels of Lakes Winnipeg, Playgreen, and Kiskittogisu for the development of water power; and,

WHEREAS Provincial lands as defined in the Water Power Act, R.S.M. 1970, Cap. W70, (hereinafter called "the Act"), are required to be used or occupied by the Licensee in carrying out the undertaking for which this Interim License is granted, the nature of the said undertaking being the construction at or near the outlet of Lake Winnipeg of a diversion channel from Lake Winnipeg to Playgreen Lake; a diversion channel from Playgreen Lake to Kiskittogisu Lake; river channel excavations at the Metchanais Rapids and Ominawin Rapids channels; two gated control structures, across the Metchanais Rapids and Ominawin Rapids channels, each being of reinforced concrete with two adjacent dams of rock fill; and all necessary machinery and equipment required for regulating water levels for the production of electric power for industrial and general purposes, as shown or described more particularly by means of the record plans and data filed with the Director, as specified hereinafter; and,

WHEREAS the Licensee has fully compiled with the requirements of the Manitoba Water Power Regulations, being Manitoba Regulation 95/45 and all amendments thereto (hereinafter called "the Regulations"), insofar as it is required for the issue to the Licensee of this Interim License; and,

WHEREAS the Licensee has duly executed an acceptance of the terms and conditions of this Interim License and has undertaken to observe and fulfill all the terms and conditions which under this Interim License and under the Regulations the Licensee is required to observe or fulfil;

NOW THEREFORE, under authority of and subject to the provisions of the Act and Regulations, this Interim License is issued, granting to the Licensee:

(a) The right to regulate the levels of Lakes Winnipeg, Playgreen, and Kiskittogisu for the development of water power, and

(b) The right to construct, operate and maintain the undertaking, the location and description of which are shown upon the record plans numbered and filed in the office of the Director at Winnipeg, except as the said undertaking may be modified or extended with the approval of the Minister of Mines and Natural Resources (hereinafter called "the Minister"), in accordance with plans previously submitted and approved.

Subject, nevertheless, to the provisions of the Regulations and of any other regulations now or hereinafter in force governing the granting or administering of Provincial lands required in connection with the regulation of water levels for the development of water power, and to the following special terms and conditions, namely:

1. Prior to the construction of any works, plans therefor shall be submitted to the Director for approval, and the Licensee shall not commence construction of any works until the Director has approved the plans therefor.
2. For the purposes of considering plans submitted under Article 1 hereof, the Director may require the Licensee to obtain and submit to him such information, reports, and evidence as the Director deems necessary.
3. ✓ Subject to Article 1 hereof, the Licensee may enter upon, use and occupy for making surveys and investigations and constructing works as may be deemed necessary for the undertaking, such lands of the Province as may reasonably be required for the said purposes and may flood such lands as are designated on a plan identified as No. 39-2-1184, or as such plan may be amended

and limited from time to time by the Minister provided that, when so requested in writing by the Director, following completion of the works and the commencement of the regulation of water levels, the Licensee shall cause a survey to be made and a plan prepared by a Manitoba Land Surveyor showing in detail the lands required to be occupied for the works and the lands required for flooding purposes only. Such survey shall be limited to include only such areas for the said purposes as the Director may approve and shall be prepared in accordance with Section 24 of the Regulation.

4. The Licensee shall also from time to time in accordance with Section 24 of the Regulations cause surveys to be made and plans prepared by a Manitoba Land Surveyor of all lands required as right-of-way for transmission lines, roads, railways, and other purposes of the undertaking, as the locations thereof become defined, as distinct from those purposes described in Article 3 hereof.

5. Subject to approval of plans of the works under Article 1 hereof, the Licensee may construct the following works:
   (a) Two diversion channels, one from Lake Winnipeg to Playgreen Lake and the other from Playgreen Lake to Kiskittogisu Lake.
   (b) River channel excavations at the Metchanais Rapids and Ominawin Rapids channels.
   (c) Two gated control structures, across the Metchanais and Ominawin Rapids channels, each being of reinforced concrete with two adjacent dams of rock fill.
   (d) All necessary machinery and equipment required for regulating water levels in Lakes Winnipeg, Playgreen, and Kiskittogisu.

6. The Licensee may regulate water levels in Lakes Winnipeg, Playgreen, and Kiskittogisu to and between the following elevations, all elevations being specified in feet above mean sea level, Canadian Geodetic Datum (with wind effect eliminated):
   (a) Lake Winnipeg - maximum 715.0 and minimum 711.0,
   (b) Playgreen Lake - maximum 714.9 and minimum 707.0, measured at the north end of Playgreen Lake,
   (c) Kiskittogisu Lake - maximum 714.8 and minimum 706.0,

   subject, however, to the provisions of Section 72 of the Regulations, which reads as follows:

"72. Every license shall be deemed to have been executed on the express condition that the licensee shall—

(a) Divert, use or store the water authorized to be diverted, used, or stored by him in such a manner as not to interfere in the opinion of the Minister, with the maximum advantageous development of the power and other resources of the river or stream upon which his works are located,

(b) Conform to and comply with any orders in respect of the control or regulation of the flow of the waters of such river or stream as may be made from time to time by the Minister or any person authorized by the Minister in that behalf;

(c) At no time cause or permit the surface-level of the waters of such river or stream or of any storage reservoir operated by him to be raised or lowered beyond the limits which shall be fixed from time to time by the Minister or by a person authorized by the Minister in that behalf."

7. The Licensee shall, during periods when the water level in Lake Winnipeg is above elevation 715.0 feet above mean sea level, Canadian Geodetic Datum, operate the said two control structures across the Metchanais and Ominawin Rapids channels in such a manner as to effect the maximum discharge possible under the circumstances then prevailing until the water level of the said lake recedes to elevation 715.0 feet above mean sea level, Canadian Geodetic Datum.

8. The Licensee shall operate the said two control structures across the Metchanais and Ominawin Rapids channels in such a manner that the combined outflow of water from Lake Winnipeg through the natural and artificial channels at any time shall not be less than 25,000 cubic feet per second.

9. Subject to Article 8 hereof, and except as may be otherwise authorized by the minister under Section 72 of the Regulation, the Licensee shall regulate the water level of Lake Winnipeg so as to prevent the water level from receding below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum.

10. Notwithstanding any other terms or conditions of this Interim License, the Licensee shall, during periods when the water level in Lake

Winnipeg is below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum, operate the said two control structures as ordered by the minister under Section 72 of the Regulation.

11. On the first day of each and every month, the Licensee shall submit a report to the Director showing the schedule for operating the two said control structures for the ensuing three month period, together with the expected daily discharges from, and water levels on, Lakes Winnipeg, Playgreen, and Kiskittogisu.

12. Subject to Article 10 hereof, but notwithstanding any other terms or conditions of this Interim License, the Licensee shall operate the two said contro [illegible] such a manner that any increase or decrease in th [illegible] combined outflow from Lakes Playgreen and Kiskittogisu during any 24 hour period shall not exceed 15,000 cubic feet per second.

13. During the term of this Interim License, the Licensee shall pay a rental for the use and occupation of those lands of the Province described in Articles 3 and 4 hereof which are situated within the Severance Line designated on a plan identified as No. 39-2-1183, in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.

14. The plans filed by the Licensee and made a part of this Interim License are as follows:

Manitoba Water Resources Branch File Number	Licensee's File Number	Description
39-2-1180	05 0-D-0303(Rev.0)	Location general arrangement and cross-sections of development
39-2-1183	--	Map showing severance line specified in license issued to Manitoba Hydro under the Water-Power Act for regulating Lakes Winnipeg, Playgreen and Kiskittogisu
39-2-1184	--	Map showing lands authorized to be flooded under license issued to Manitoba Hydro under the Water Power Act for regulating Lakes Winnipeg, Playgreen, and Kiskittogisu.

15. Upon the satisfactory completion by the Licensee of the undertaking and upon the due observance and fulfillment by it of all the terms and conditions required by this Interim License and under the Regulations to be by it observed and fulfilled, the Minister shall and will issue in favour of the Licensee a Final License for the regulation of water levels, and for the use or occupation of those lands of the Province which, in the Minister's opinion, are required for the proper operation and mainenance of the works authorised. The said Final License shall be issued subject to the regulations then in force and shall embody such matters as the Minister may determine in accordance with the Regulations, and the following terms and conditions, namely:

(a) The undertaking in respect of which the Final License is to be issued is to comprise:

  (i) Two diversion channels, one from Lake Winnipeg to Playgreen Lake and the other from Playgreen Lake to Kiskittogisu Lake.

  (ii) River channel excavations at the Metchanais Rapids and Ominawin Rapids channels.

  (iii) Two gated control structures, across the Metchanais Rapids and Ominawin Rapids channels, each being of reinforced concrete with two adjacent dams of rock fill.

  (iv) All necessary machinery and equipment required for regulating water levels in Lakes Winnipeg, Playgreen, and Kiskittogisu.

(b) The Licensee may regulate water levels in Lakes Winnipeg, Playgreen and Kiskittogisu to and between the following elevations, all elevations being specified in feet above mean seal level, Canadian Geodetic Datum (with wind effect eliminated):

  (i) Lake Winnipeg - maximum 715.0 and minimum 711.0

  (ii) Playgreen Lake - maximum 714.9 and minimum 707.0, measured at the north end of Playgreen Lake,

  (iii) Kiskittogisu Lake - maximum 714.8 and minimum 706.0, subject, however, to the provisions of Section 72 of the Regulations which reads as follows:

> "72. Every license shall be deemed to have been executed on the express condition that the lecensee shall--
>
> (a) Divert, use, or store the water authorized to be diverted, used, or stored by him in such a manner as not to interfere in the opinion of the Minister, with the maximum advantageous development of the power and other resources of the river or stream upon which his works are located;
>
> (b) Conform to and comply with any orders in respect of the control or regulation of the flow of the waters of such river or stream as may be made from time to time by the Minister or any person authorized by the Minister in that behalf;

> (c) At no time cause or permit the surface-level of the waters of such river or stream or of any storage reservoir operated by him to be raised or lowered beyond the limits which shall be fixed from time to time by the Minister or by a person authorized by the Minister in that behalf."

(c) The Licensee shall, during periods when the water level in Lake Winnipeg is above elevation 715.0 feet above mean sea level, Canadian Geodetic Datum, operate the said two control structures across the Ketchanais and Ominawin Rapids channels in such a manner as to effect the maximum discharge possible under the circumstances then prevailing until the water level of the said lake recedes to elevation 715.0 feet above mean sea level, Canadian Geodetic Datum.

(d) The Licensee shall operate the said two control structures across the Ketchanais and Ominawin Rapids channels in such a manner that the combined outflow of water from Lake Winnipeg through the natural and artificial channels at any time shall not be less than 25,000 cubic feet per second.

(e) Subject to Article 8 of the Interim License, and except as may be otherwise authorized by the minister under Section 72 of the Regulations, the Licensee shall regulate the water level of Lake Winnipeg so as to prevent the water level from receding below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum.

(f) Notwithstanding any other terms or conditions of this Final License, the Licensee shall, during periods when the water level in Lake Winnipeg is below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum, operate the said two control structures as ordered by the minister under Section 72 of the Regulations.

(g) On the first day of each and every month, the Licensee shall submit a report to the Director showing the schedule for operating the two said control structures for the ensuing three month period, together with the expected daily discharges from, and water levels on, Lakes Winnipeg, Playgreen, and Kiskittogisu.

(h) Subject to Article 10 of the Interim License, but notwithstanding any other terms or conditions of the Interim License, the Licensee shall operate the two said control structures in such a manner that any increase or decrease in the rate of the combined outflow from Lakes Playgreen and Kiskittogisu during any 24 hour period shall not exceed 15,000 cubic feet per second.

(i) During the term of the Final License, the Licensee shall pay a rental for the use and occupation of those lands of the Province described in Articles 3 and 4 of the Interim License which are situated within the Severance Line designated on a plan identified as No. 39-2-1183, in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.

(j) The term of the Final License shall be fifty (50) years from the date of issuance thereof and shall be subject to renewal or extension in accordance with the provisions of the Laws and Regulations relating thereto and then in force.

(k) The Severance Line as defined in Section 1 of the Regulations shall be shown in red and marked "Severance Line" upon record plan No. 39-2-1183, on file in the office of the Director.

16. All record plans filed with the Director and referred to in this Interim License are incorporated herewith and made a part hereof.

17. This Interim License is issued upon the express condition that it shall be subject to the provisions of the Regulations and all amendments thereto.

Issued at Winnipeg this 18th day of November A.D. 1970 at the direction of the Honourable Minister of Mines and Natural Resources.

Sidney Green

Minister of Mines and Natural Resources.

APPENDIX 1 - D

SUPPLEMENTARY INTERIM LICENSE FOR THE REGULATION OF WATER LEVELS FOR WATER POWER PURPOSES - LAKES WINNIPEG, PLAYGREEN AND KISKITTOGISU

SUPPLEMENTARY INTERIM LICENSE FOR THE REGULATION OF WATER LEVELS FOR WATER POWER PURPOSES - LAKES WINNIPEG, PLAYGREEN AND KISKITTOGISU

issued by

Manitoba Department of Mines, Resources and Environmental Management
Winnipeg, Manitoba
August, 1972

PROVINCE OF MANITOBA

DEPARTMENT OF MINES, RESOURCES AND ENVIRONMENTAL MANAGEMENT

WATER RESOURCES BRANCH

SUPPLEMENTARY INTERIM LICENSE FOR THE REGULATION OF WATER LEVELS FOR WATER POWER PURPOSES

Lakes Winnipeg, Playgreen, and Kiskittogisu

Issued in accordance with the provisions of the Water Power Act, Chapter W70, Revised Statutes of Manitoba, 1970, and amendments, and of the Regulations in force thereunder to govern the mode of granting and administering Provincial water-power rights.

WHEREAS Manitoba Hydro, a corporation duly incorporated by Act of the Legislature of the Province of Manitoba, and whose head office address is Box 815, Winnipeg 1, Manitoba, (hereinafter called "the Licensee"), by Interim License dated November 18, 1970, issued in accordance with the provisions of the Water Power Act, R.S.M. 1970, Cap. W70 (hereinafter called "the Act"), and the Manitoba Water Power Regulations, being Manitoba Regulation 75/45 and all amendments thereto (hereinafter called "the Regulations"), was granted the right to regulate the water levels of Lakes Winnipeg, Playgreen, and Kiskittogisu for the development of water power; to construct, operate and maintain the undertaking, the location and description of which are shown on record plans filed in the office of the Director General of Water Resources (Director of the Water Resources Branch, hereinafter called "the Director") in Winnipeg; and to occupy certain lands of the Province required for these purposes; and,

WHEREAS the development authorized to be maintained by the Licensee by the said Interim License includes the construction at or near the outlet of Lake Winnipeg of a diversion channel from Lake Winnipeg to Playgreen Lake; a diversion channel from Playgreen Lake to Kiskittogisu Lake; river channel excavations at the Metchanais Rapids and Ominawin Rapids channels; two gated control structures, across the Metchanais Rapids and Ominawin Rapids channels, each being of reinforced concrete with two adjacent dams of rock fill; and all necessary machinery and equipment required for regulating water levels for the production of electric power for industrial and general purposes, as shown or described more particularly by means of the record plans and data filed with the Director, as specified hereinafter; and, WHEREAS the Licensee is desirous of relinquishing the right to construct certain of the works authorized under the said Interim License including river channel excavations and control structures at Metchanais and Ominawin Rapids, and of acquiring instead the right to construct alternative works including a control structure at a site known as Jenpeg, a river channel excavation at Kisipachewuk Rapids, a by-pass channel at Ominawin Rapids, a dam and dykes at the natural outlet of Kiskitto Lake, a diversion channel from Stan Creek to Kiskitto Lake, and a diversion channel from Kiskitto Lake to the Minago River drainage basin with control structure; and

WHEREAS Section 39 of the Regulations reads as follows:

> "39. Subject to these regulations the terms of any interim license may be amended by a supplementary license entered into between the Minister and the interim licensee; and plans and specifications previously approved may be amended with the consent in writing of the Minister, but any such amendment shall affect only the portion specifically covered in such supplementary license or writing, and shall in no case operate to alter or amend or in any way whatsoever be a waiver of any other part, condition or provision of the original interim license." and,

WHEREAS the Licensee by letter dated January 20, 1972, signed by J.F. Funnell, General Counsel and Secretary, has filed with the Director an application for a supplementary interim license to amend the said Interim License; and,

WHEREAS the Licensee has fully complied with the requirements of the Regulations insofar as it is required for the issue to the Licensee of this Supplementary Interim License amending the said Interim License; and,

WHEREAS the Licensee has duly executed an acceptance of the terms and conditions of this Supplementary Interim License amending the said Interim License and has undertaken to observe and fulfil all the terms and conditions which under this Supplementary Interim License and under the Regulations the Licensee is required to observe or fulfil; and,

WHEREAS it is deemed expedient and advisable to issue a Supplementary Interim License amending the Interim License dated November 18, 1970;

NOW THEREFORE, under authority of and subject to the provisions of the Act and the Regulations, this Supplementary Interim License is issued amending the said Interim License dated November 18, 1970 by deleting Articles 3, 5, 7, 8, 10, 11, 12, 13, 14, and 15 thereof, and substituting new Articles 3, 5, 7, 8, 10, 11, 12, 12A, 13, 14, and 15 therefor, as follows:

3. Subject to Article 1 hereof, the Licensee may enter upon, use and occupy for making surveys and investigations and constructing works as may be deemed necessary for the undertaking, such lands of the Province as may reasonably be required for the said purposes and may flood such lands as are designated on a plan identified as No. 39-2-1184 (Rev. 1), or as such plan may be amended and limited from time to time by the Minister provided that, when so requested in writing by the Director, following completion of the works and the commencement of the regulation of water levels, the Licensee shall cause a survey to be made and a plan prepared by a Manitoba Land Surveyor showing in detail the lands required to be occupied for the works and the lands required for flooding purposes only. Such survey shall be limited to include only such areas for the said purposes as the Director may approve and shall be prepared in accordance with Section 24 of the Regulations.

5. Subject to approval of plans of the works under Article 1 hereof, the Licensee may construct the following works:

   (a) Two diversion channels, one from Lake Winnipeg to Playgreen Lake and the other from Playgreen Lake to Kiskittogisu Lake.

   (b) River channel excavation at the Kisipachewuk Rapids channel.

   (c) A reinforced concrete control structure at a site known as Jenpeg on the west channel of the Nelson River with adjacent reinforced concrete headblock with gated openings forming part of the control works (which may be later utilized for a future generating station if so licensed under the Act), also with rockfill abutment and channel closure dams, and earthfill saddle closure dams.

   (d) A by-pass channel at Ominawin Rapids.

(e) Intermittent earthfill dykes along the west side of Kiskittogisu Lake and the Kisipachewuk Rapids channel, and across the Kiskitto Lake outlet.

(f) A diversion channel from Stan Creek to Kiskitto Lake.

(g) A diversion channel from Kiskitto Lake to a tributary of the Minago River, with a small overflow weir or stop log control structure.

(h) All necessary machinery and equipment required for regulating water levels in Lakes Winnipeg, Playgreen, and Kiskittogisu.

7. The Licensee shall, during periods when the water level in Lake Winnipeg is above elevation 715.0 feet above mean sea level, Canadian Geodetic Datum, operate the said control structure at Jenpeg in such a manner as to effect the maximum discharge possible under the circumstances then prevailing until the water level of the said lake recedes to elevation 715.0 feet above mean sea level, Canadian Geodetic Datum.

8. The Licensee shall operate the said control structure at Jenpeg in such a manner that the combined outflow of water from Lake Winnipeg through the natural and artificial channels at any time shall not be less than 25,000 cubic feet per second.

10. Notwithstanding any other terms or conditions of this Interim License, the Licensee shall, during periods when the water level in Lake Winnipeg is below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum, operate the said control structure at Jenpeg as ordered by the Minister under Section 72 of the Regulations.

11. On the first day of each and every month, the Licensee shall submit a report to the Director showing the schedule for operating the said control structure at Jenpeg for the ensuing three month period, together with the expected daily discharges from, and water levels on, Lakes Winnipeg, Playgreen, and Kiskittogisu.

12. Subject to Article 10 hereof, but notwithstanding any other terms or conditions of this Interim License, the Licensee shall operate the said control structure at Jenpeg in such a manner that any increase or decrease in the rate of the discharge therefrom during any 24 hour period shall not exceed 15,000 cubic feet per second.

12A. The Licensee shall operate the said control structure on the Kiskitto-Minago diversion channel in such a manner as to regulate water levels in Kiskitto Lake within natural ranges subject to the orders of the Director.

13. During the term of this Interim License, the Licensee shall pay a rental for the use and occupation of those lands of the Province described in Articles 3 and 4 hereof which are situated within the Severance Line designated on a plan identified as No. 39-2-1183 (Rev. 1), in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.

14. The plans filed by the Licensee and made a part of this Interim License are as follows:

Manitoba Water Resources Branch File Number	Licensee's File Number	Description
39-3-1018	0510-D-9172 (Rev. 1)	Location general arrangement and cross-sections of development
39-2-1183 (Rev. 1)	—	Map showing severance line specified in license issued to Manitoba Hydro under the Water-Power Act for regulating Lakes Winnipeg, Playgreen and Kiskittogisu
39-2-1184 (Rev. 1)	—	Map showing lands of the Province authorized to be flooded under license issued to Manitoba Hydro under the Water Power Act for regulating Lakes Winnipeg, Playgreen, and Kiskittogisu.

15. Upon the satisfactory completion by the Licensee of the undertaking and upon the due observance and fulfillment by it of all the terms and conditions required by this Interim License and under the Regulations to be by it observed and fulfilled, the Minister shall and will issue in favour of the Licensee a Final License for the regulation of water levels, and for the use or occupation of those lands of the Province which, in the Minister's opinion, are required for the proper operation and maintenance of the works authorized. The said Final License shall be issued subject to the regulations then in force and shall embody such matters as the Minister may determine in accordance with the Regulations, and the following terms and conditions, namely:

(a) The undertaking in respect of which the Final License is to be issued is to comprise:

(i) Two diversion channels, one from Lake Winnipeg to Playgreen Lake and the other from Playgreen Lake to Kiskittogisu Lake.

(ii) River channel excavation at the Kisipachewuk Rapids channel.

(iii) A reinforced concrete control structure at a site known as Jenpeg on the west channel of the Nelson River with adjacent reinforced concrete headblock with gated openings forming part of the control works (which may be later utilized for a future generating station if so licensed under the Act), also with rockfill abutment and channel closure dams, and earthfill saddle closure dams.

(iv) A by-pass channel at Ominawin Rapids.

(v) Intermittent earthfill dykes along the west side of Kiskittogisu Lake and the Kisipachewuk Rapids channel, and across the Kiskitto Lake outlet.

(vi) A diversion channel from Stan Creek to Kiskitto Lake.

(vii) A diversion channel from Kiskitto Lake to a tributary of the Minago River, with a small overflow weir or stop log control structure.

(viii) All necessary machinery and equipment required for regulating water levels in Lakes Winnipeg, Playgreen, and Kiskittogisu.

(b) The Licensee may regulate water levels in Lakes Winnipeg, Playgreen and Kiskittogisu to and between the following elevations, all elevations being specified in feet above mean sea level, Canadian Geodetic Datum (with wind effect eliminated):

(i) Lake Winnipeg - maximum 715.0 and minimum 711.0,

(ii) Playgreen Lake - maximum 714.9 and minimum 707.0, measured at the north end of Playgreen Lake,

(iii) Kiskittogisu Lake - maximum 714.8 and minimum 706.0, subject, however, to the provisions of Section 72 of the Regulations which reads as follows:

"72. Every license shall be deemed to have been executed on the express condition that the licensee shall—

(a) Divert, use, or store the water authorized to be diverted, used, or stored by him in such a manner as not to interfere in the opinion of the Minister, with the maximum advantageous development of the power and other resources of the river or stream upon which his works are located;

(b) Conform to and comply with any orders in respect of the control or regulation of the flow of the waters of such river or stream as may be made from time to time by the Minister or any person authorized by the Minister in that behalf;

(c) At no time cause or permit the surface-level of the waters of such river or stream or of any storage reservoir operated by him to be raised or lowered beyond the limits which shall be fixed from time to time by the Minister or by a person authorized by the Minister in that behalf."

(c) The Licensee shall, during periods when the water level in Lake Winnipeg is above elevation 715.0 feet above mean sea level, Canadian Geodetic Datum, operate the said control structure at Jenpeg in such a manner as to effect the maximum discharge possible under the circumstances then prevailing until the water level of the said lake recedes to elevation 715.0 feet above mean sea level, Canadian Geodetic Datum.

(d) The Licensee shall operate the said control structure at Jenpeg in such a manner that the combined outflow of water from Lake Winnipeg through the natural and artificial channels at any time shall not be less than 25,000 cubic feet per second.

(e) Subject to Article 8 of the Interim License, and except as may be otherwise authorized by the Minister under Section 72 of the Regulations, the Licensee shall regulate the water level of Lake Winnipeg so as to prevent the water level from receding below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum.

(f) Notwithstanding any other terms or conditions of this Final License, the Licensee shall, during periods when the water level in Lake Winnipeg is below elevation 711.0 feet above mean sea level, Canadian Geodetic Datum, operate the said control structure at Jenpeg as ordered by the Minister under Section 72 of the Regulations.

(g) On the first day of each and every month, the Licensee shall submit a report to the Director showing the schedule for operating the said control structure at Jenpeg for the ensuing three month period, together with the expected daily discharges from, and water levels on, Lakes Winnipeg, Playgreen, and Kiskittogisu.

(h) Subject to Article 10 of the Interim License, but notwithstanding any other terms or conditions of the Interim License, the Licensee shall operate the said control structure at Jenpeg in such a manner that any increase or decrease in the rate of the discharge therefrom during any 24 hour period shall not exceed 15,000 cubic feet per second.

(i) The Licensee shall operate the said control structure on the Kiskitto-Kinago diversion channel in such a manner as to regulate water levels in Kiskitto Lake within natural ranges subject to the orders of the Director.

(j) During the term of the Final License, the Licensee shall pay a rental for the use and occupation of those lands of the Province described in Articles 3 and 4 of the Interim License which are situated within the Severance Line designated on a plan identified as No. 39-2-1183 (Rev. 1), in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.

(k) The term of the Final License shall be fifty (50) years from the date of issuance thereof and shall be subject to renewal or extension in accordance with the provisions of the Laws and Regulations relating thereto and then in force.

(l) The Severance Line as defined in Section 1 of the Regulations shall be shown in red and marked "Severance Line" upon record plan No. 39-2-1183 (Rev. 1), on file in the office of the Director.

All other terms of the said Interim License shall otherwise remain unaltered.

Issued at Winnipeg this 9th day of August A.D. 1972 at the direction of the Honourable Minister of Mines, Resources and Environmental Management.

Sidney Green

MINISTER OF MINES, RESOURCES AND ENVIRONMENTAL
MANAGEMENT.

APPENDIX 1 - E

INTERIM LICENSE FOR THE DEVELOPMENT OF WATER POWER - JENPEG SITE, WEST CHANNEL OF NELSON RIVER

INTERIM LICENSE FOR THE DEVELOPMENT OF WATER POWER - JENPEG SITE, WEST CHANNEL OF NELSON RIVER

issued by

Manitoba Department of Mines, Resources and Environmental Management
Winnipeg, Manitoba
December, 1972

PROVINCE OF MANITOBA

DEPARTMENT OF MINES, RESOURCES AND ENVIRONMENTAL MANAGEMENT

WATER RESOURCES BRANCH

INTERIM LICENSE FOR THE DEVELOPMENT OF WATER POWER

Jenpeg Site, West Channel of Nelson River

Issued in accordance with the provisions of the Water Power Act, Chapter W70, Revised Statutes of Manitoba, 1970, and amendments, and of the Regulations in force thereunder to govern the mode of granting and administering Provincial water-power rights.

WHEREAS Manitoba Hydro, a corporation duly incorporated by Act of the Legislature of the Province of Manitoba, and whose head office address is Box 815, Winnipeg 1, Manitoba, (hereinafter called "the Licensee"), by letter dated January 20, 1972, signed by J.F. Funnell, General Counsel and Secretary, and by other documents attached thereto, has filed with the Director General of Water Resources (Director of the Water Resources Branch, hereinafter called "the Director") at Winnipeg an application for a license to divert and use water for the development of power at the Jenpeg site on the West Channel of the Nelson River; and,

WHEREAS Provincial water-powers and lands as defined in the Water Power Act, R.S.M. 1970, Cap. W70, (hereinafter called "the Act"), are required to be used or occupied by the Licensee in carrying out the undertaking for which this Interim License is granted, the nature of the said undertaking being the construction of a reinforced concrete powerhouse situated adjacent to the Jenpeg control structure (the Jenpeg diversion channel and control structure were authorized to be constructed by interim license, as amended by supplementary interim license, for the control and regulation of Lakes Winnipeg, Playgreen and Kiskittogisu); and all necessary machinery and equipment required for the development, generation, transformation, and transmission of electric power for industrial and general purposes, as shown or described more particularly by means of the record plans and data filed with the Director, as specified hereinafter; and,

WHEREAS the Licensee has fully complied with the requirements of the Manitoba Water Power Regulations, being Manitoba Regulation 95/45 and all amendments thereto (hereinafter called "the Regulations"), insofar as it is required for the issue to the Licensee of this Interim License; and, WHEREAS the Licensee has duly executed an acceptance of the terms and conditions of this Interim License and has undertaken to observe and fulfil all the terms and conditions which under this Interim License and under the Regulations the Licensee is required to observe or fulfil;

NOW THEREFORE, under authority of and subject to the provisions of the Act and Regulations, this Interim License is issued, granting to the Licensee:

(a) The right to divert and use waters of the West Channel of the Nelson River at the Jenpeg site,

(b) The right to develop electric power and energy from the said waters,

(c) The right to generate, transmit, distribute, sell and deliver the said electric power and energy and for that purpose to use and occupy the lands of the Province hereinafter described, and

(d) The right to construct, operate and maintain the undertaking, the location and description of which are shown upon the record plans numbered and filed in the office of the Director at Winnipeg, except as the said undertaking may be modified or extended with the approval of the Minister of Mines, Resources and Environmental Management (hereinafter called "the Minister"), in accordance with plans previously submitted and approved.

Subject, nevertheless, to the provisions of the Regulations and of any other regulations now or hereinafter in force governing the granting or administering of Provincial water-powers and the lands required in connection with the development and use thereof, and to the following special terms and conditions, namely:

1. The Licensee shall file the general construction plans of the undertaking authorized hereby with the Director in such form and detail as is required by the Regulations within three (3) months from the date of this Interim License.

2. After the general construction plans have been approved, the Licensee shall begin the construction of the undertaking authorized hereby within the time limit provided in the Regulations, and shall thereafter without interruption, except such as may be

occasioned by act of God or other major cause beyond the control of the said Licensee (other than want of funds), carry on and complete the construction of the said undertaking according to the plans so approved or as the same may be amended or modified at the direction and with approval of the Minister during the progress of construction, and subject to the terms of this Interim License and of the Regulations.

3. Subject to Article 1 hereof, the Licensee may enter upon, use and occupy for making surveys and investigations and constructing works as may be deemed necessary for the undertaking, such lands of the Province as may reasonably be required for the said purposes provided that, when so requested in writing by the Director, following completion of the works and the commencement of the production of power, the Licensee shall cause a survey to be made and a plan prepared by a Manitoba Land Surveyor showing in detail the lands required to be occupied for the works. Such survey shall be limited to include only such areas for the said purpose as the Director may approve and shall be prepared in accordance with Section 24 of the Regulations.

4. Within five (5) years from the date of this Interim License, the Licensee shall have satisfactorily completed the undertaking and shall have installed all the machinery and equipment required for an initial development of up to six turbine generator units having a total capacity of not less than two hundred and twenty thousand (220,000) horsepower, measured on the turbine shaft, and shall be in a position to apply the power to beneficial use.

5. The Licensee shall notify the Director in writing of the commissioning date of each unit within 30 days of commissioning, and shall also notify the Director in writing when the initial development is completed. The Director shall, in accordance with the provisions of Subsection (4) of Section 42 of the Regulations, determine a date which, for the purpose of the

Interim License and Regulations, shall be the date of completion of the initial development and shall be the earlier of:

(a) the date on which all of the turbine generator units comprising the initial development have been commissioned; or

(b) the date fixed in Article 4 hereof as the limiting date by which the initial development is to be completed, whether the same shall have been completed or not.

6. The Licensee may divert and use continuously for the development of power at the said Jenpeg site all the water of the West Channel of the Nelson River which may be flowing at the said site from time to time during the term of this Interim License, subject, however, to the provisions of Section 72 of the Regulations.

7. On the second day of January in each and every year during the term of this Interim License, the Licensee shall pay an annual rental in advance of five hundred dollars ($500.00) for the use and occupation of those lands of the Province described in Article 3 hereof. The first payment of such rental shall be made on the second day of January following the date of completion of the initial development as determined by the Director under Article 5 hereof. Such first payment shall consist of an amount due for the preceding year, which shall be prorated to cover that portion of the year between the said date of completion of the initial development and the end of the year, together with the amount due in advance for the current year.

8. From the date of completion of the initial development determined in accordance with Article 5 hereof, and during the remaining term of this Interim License, the Licensee shall pay annually, in arrears, as rental for water used in the development of power, an amount determined in accordance with the principles set out in Section 48 of the Regulations, being whichever is the greater of:

(a) A rental at the rate of fifty (50) cents per installed horsepower of turbine capacity, based on the initial development of not less than 220,000 horsepower; or

(b) A rental at the rate of one dollar and twenty-five cents ($1.25) per horsepower-year of output measured on the turbine shaft, such output to be calculated in the manner provided in Subsection (9) of Section 48, of the Regulations.

The first payment of annual water rental is to be for that part of the year between the date of completion of the initial development determined in accordance with Article 5 hereof, and the end of the then current calendar year. Subsequent payments are to be for each successive calendar year, or part thereof, during which the Licensee continues operations. In each case the Licensee shall, on or before the first day of March in each year following any calendar year for which rental is payable, submit all data required by the Director for the determination of its rental for the preceding calendar year. The Director shall thereupon prepare and submit to the Licensee a statement of the rental due. Payment shall be made within sixty (60) days of submission of the said statements; otherwise the penalties provided in Subsections (4) and (6) inclusive of Section 43 of the Regulations shall apply.

9. Notwithstanding Article 8 hereof, if the Licensee commences the generation and transmission of power prior to the date fixed for completion of the initial development in accordance with Article 5 hereof, by and from any turbine generator unit commissioned prior to the said date, the Licensee shall pay annually, in arrears, for the water used in the development of power a rental at the rate of one dollar and twenty-five cents ($1.25) per horsepower-year of output measured on the turbine shaft, such output to be calculated in the manner provided in Subsection (9) of Section 43, of the Regulations. The first payment of annual water rental for each turbine generator unit is to be for that part of the year between the date of commissioning of each turbine generator unit, or a date fixed by the Lieutenant Governor in Council, whichever is the earlier, and the end of the then calendar year. Subsequent payments are to be for each successive calendar year, or part thereof until the date of completion of the initial development determined in accordance with Article 5 hereof. In each case the Licensee shall, on or before the first day of March in each year following any calendar

year for which rental is payable, submit all data required by the Director for the determination of the rental for the preceding calendar year. The Director shall thereupon prepare and submit to the Licensee a statement of the rental due. Payment shall be made within sixty (60) days of submission of the said statements.

10. The plans filed by the Licensee and made a part of this Interim License are as follows:

Manitoba Water Resources Branch File Number	Licensee's File Number	Description
39-3-1019	0198-D-0202 (Rev. 0)	Location general arrangement and cross-sections of Development
39-3-1020	0198-D-0203 (Rev. 0)	Plan showing Severance Line for Generating Station

11. Upon the satisfactory completion by the Licensee of the initial development in accordance with Article 4 hereof and upon the due observance and fulfilment by it of all the terms and conditions required by this Interim License and under the Regulations to be by it observed and fulfilled, the Minister shall and will issue in favour of the Licensee a Final License for the use of water, for the development of energy therefrom, for the utilization of such energy, and for the use or occupation of those lands of the Province which, in the Minister's opinion, are required for the proper operation and maintenance of the works authorized. The said Final License shall be issued subject to the regulations then in force and shall embody such matters as the Minister may determine in accordance with the Regulations, and the following terms and conditions, namely:

(a) The Licensee may divert and use continuously for the development of power at the said Jenpeg site all the water of the West Channel of the Nelson River which may be flowing at the said site from time to time during the term of this Final License, subject, however, to the provisions of Section 72 of the Regulations.

(b) The Licensee shall, during the term of the Final License pay annually in advance on the second day of January in each year an annual rental of five hundred dollars ($500.00) for those lands of the Province to be described in the Final License, and used for the purposes described in Article 3 of the Interim License.

(c) The Licensee shall also pay an annual rental during the term of the Final License for the use of water for the development of power, determined in accordance with the principles set out in Section 48 of the Regulations and payable at the times and in the manner therein provided, and at the following rates:

  (i) The rentals in the twenty-year period directly following the date of completion of the initial development determined in accordance with Article 5 hereof shall be the greater of:

    (a) An annual rental of fifty (50) cents per installed horsepower;

    (b) An annual rental of one dollar and twenty-five cents ($1.25) per horsepower year.

  (ii) The annual rental to be paid after the expiry of the said twenty-year period shall be determined as provided in the regulations in force at such time.

(d) The undertaking in respect of which the Final License is to be issued is to comprise: a reinforced concrete powerhouse with up to six turbine generator units, having a total capacity of not less than 220,000 horsepower; and all plant machinery and equipment requisite for the complete development and utilization of the power economically available at the said Jenpeg site, together with such other approved works as have been constructed for purposes of the undertaking for which the Final License is to be issued.

(e) The energy developed under the said Final License may be generated, transmitted, sold and delivered for the purposes and within the area permitted by the Act.

(f) In accordance with Section 45 of the Regulations the term of the Final License shall be fifty (50) years from and after the date fixed in accordance with Article 5 of the Interim License for the completion of the initial development and shall be subject to renewal or extension in accordance with the provisions of the Laws and Regulations relating thereto and then in force.

(g) The Severance Line as defined in Section 1 of the Regulations shall be as shown in red and marked "Severance Line" upon record plan No. 39-3-1020 (Manitoba Hydro No. 0198-D-0203 (Rev. 0)) on file in the office of the Director.

12. All record plans filed with the Director and referred to in this Interim License are incorporated herewith and made a part hereof.

13. This Interim License is issued upon the express condition that it shall be subject to the provisions of the Regulations and all amendments thereto.

Issued at Winnipeg this 14th day of December A.D., 1972 at the direction of the Honourable Minister of Mines, Resources and Environmental Management.

Sidney Green

Minister

APPENDIX 1 - F

INTERIM LICENSE FOR THE DIVERSION OF WATER FROM THE CHURCHILL RIVER TO THE NELSON RIVER, AND THE IMPOUNDMENT OF WATER ON THE RAT RIVER AND SOUTHERN INDIAN LAKE

INTERIM LICENSE FOR THE DIVERSION OF WATER FROM THE CHURCHILL RIVER TO THE NELSON RIVER, AND THE IMPOUNDMENT OF WATER ON THE RAT RIVER AND SOUTHERN INDIAN LAKE

issued by

Manitoba Department of Mines, Resources and Environmental Management
Winnipeg, Manitoba
May, 1973

PROVINCE OF MANITOBA

DEPARTMENT OF MINES, RESOURCES AND ENVIRONMENTAL MANAGEMENT

WATER RESOURCES BRANCH

INTERIM LICENSE FOR THE DIVERSION OF WATER FROM THE CHURCHILL RIVER TO THE NELSON RIVER, AND THE IMPOUNDMENT OF WATER ON THE RAT RIVER AND SOUTHERN INDIAN LAKE

Issued in accordance with the provisions of the Water Power Act, Chapter W70, Revised Statutes of Manitoba, 1970, and amendments, and of the Regulations in force thereunder to govern the mode of granting and administering Provincial water-power rights.

WHEREAS Manitoba Hydro, a corporation duly incorporated by Act of the Legislature of the Province of Manitoba, and whose head office address is Box 815, Winnipeg 1, Manitoba, (hereinafter called "the Licensee"), by letter dated May 2, 1973 signed by J.P. Funnell, General Counsel and Secretary, and by other documents attached thereto, has filed with the Director General of Water Resources at Winnipeg (Director of the Water Resources Branch, hereinafter called "the Director") an application for a license to divert water from the Churchill River into the Nelson River and to impound water on the Rat River and Southern Indian Lake, for the development of water power; and

WHEREAS Provincial lands as defined in the Water Power Act, R.S.M. 1970, Cap. W70 (hereinafter called "the Act") are required to be used or occupied by the Licensee in carrying out the undertaking for which this Interim License is granted, the nature of the said undertaking being the construction of control dams at the natural outlets of Southern Indian Lake at Missi Falls; an excavated diversion channel from South Bay on Southern Indian Lake to Issett Lake; control dams on the Rat River approximately four miles downstream from Notigi Lake; and all necessary machinery and equipment required for controlling the diversion and impoundment of water for the development of water power, as shown or described more particularly by means of the record plans and data filed with the Director, as specified hereinafter; and,

WHEREAS the Licensee has fully complied with the requirements of the Manitoba Water Power Regulations, being Manitoba Regulation 95/45 and all amendments thereto (hereinafter called "the Regulations"), insofar as it is required for the issue to the said Licensee of this Interim License; and, WHEREAS the Licensee has duly executed an acceptance of the terms and conditions of this Interim License and has undertaken to observe and fulfil all the terms and conditions which under this Interim License, and under the Regulations and all amendments thereto as may be made from time to time, the said Licensee is required to observe or fulfil;

NOW THEREFORE, under authority of and subject to the provisions of the Act and Regulations, this Interim License is issued, granting to the Licensee: .

(a) The right to divert water from the Churchill River into the Nelson River, and to impound water on the Rat River and Southern Indian Lake, for the development of water power, and

(b) The right to construct, operate and maintain the undertaking, the location and description of which are shown upon the record plans numbered and filed in the office of the Director at Winnipeg, except as the said undertaking may be modified or extended with the prior approval of the Minister of Mines, Resources and Environmental Management (hereinafter called "the Minister").

Subject, nevertheless, to the provisions of the Regulations and of any other regulations now or hereinafter in force governing the granting or administering of Provincial lands required in connection with the diversion and storage of water for the development of water power, and to the following special terms and conditions, namely:-

1. The Licensee shall file the general construction plans of the undertaking authorized hereby with the Director in such form and detail as is required by the Regulations within three (3) months from the date of this Interim License.
2. After the general construction plans have been approved, the Licensee shall begin the construction of the undertaking authorized hereby within the time limit provided in the Regulations, and shall thereafter without interruption, except such as may be occasioned by act of God or other major cause beyond the control of the said Licensee (other than want of funds), carry on and complete the construction of the said undertaking according to the plans so approved or as the same may be amended or modified at the direction and with prior approval of the Minister during the progress of construction, and subject to the terms of this Interim License and of the Regulations and all amendments thereto as may

3. Within five (5) years from the date of this Interim License, the Licensee shall have satisfactorily completed the undertaking and shall have installed all the machinery and equipment required for a development capable of diverting waters of the Churchill River to the Nelson River, and of impounding an estimated 41,600 c.f.s. months of water above elevation 844.0 feet for the development of water power, as authorized by this License.

4. The Licensee shall notify the Director in writing of the completion of the development, and the Director shall thereupon determine a date which, for the purpose of the Interim License and Regulations, shall be the date of completion of the development and shall be the earlier of:

   (a) the actual date on which the development commences the diversion of waters of the Churchill River

   (b) the date fixed in Article 3 hereof as the limiting date by which the development is to be completed, whether the same shall have been completed or not.

5. The Licensee may enter upon, use and occupy for making surveys and investigations and constructing works as may be deemed necessary for the undertaking, such lands of the Province as may reasonably be required for the said purposes and may flood such lands as are designated on a plan identified as No. 60-1-1007 or as such plan may be amended and limited from time to time by the Minister provided that, when so requested in writing by the Director, following completion of the development and the commencement of the diversion and/or storage of water, the Licensee shall cause a survey to be made and a plan prepared by a Manitoba Land Surveyor showing in detail the lands required to be occupied for the purposes of the diversion and storage development and the lands required for flooding purposes only, such survey shall be limited to include only such areas for the said purposes as the Director may approve and shall be prepared in accordance with Section 24 of the Regulations.

6. The Licensee shall also from time to time in accordance with Section 24 of the Regulations cause surveys to be made and plans prepared by a Manitoba Land Surveyor of all lands required as rights-of-way for transmission lines, roads, railways and other purposes of the undertaking, as the locations thereof become defined, as distinct from those purposes described in Article 5 hereof.

7. The Licensee may divert and store for the development of water power the water of the Churchill River which may be flowing from time to time during the term of this Interim License, subject, however, to the provisions of Section 72 of the Regulations and Articles 10 and 11 hereof.

8. The Licensee shall pay a rental for the use and occupation of Crown lands required for the purposes described in Articles 5 and 6 hereof in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.

9. Subject to Article 11 hereof, and except as may be otherwise authorized by the Minister, the Licensee shall, during periods when the water level of Southern Indian Lake is above elevation 847 feet, operate the Missi Falls and Notigi control structures in such a manner as to effect the maximum discharge possible under the circumstances then prevailing until the water level of the said lake returns to elevation 847 feet.

10. Subject to Article 12 hereof, and except as may be otherwise authorized by the Minister, the Licensee shall regulate the water level of Southern Indian Lake so as to prevent the water level from receding below elevation 844 feet.

11. The Licensee shall not release more than an average weekly flow of 30,000 cubic feet per second through the Notigi control structure, and shall vary the magnitude of the release through that structure from time to time in order to ensure that the flow in the Burntwood River, as measured at the Provincial Government gauging station at Thompson, shall not exceed the average mean flow plus 30,000 cubic feet per second.

12. Releases from Missi Falls control structure shall not be less than 500 cubic feet per second during the open water period

and 1500 cubic feet per second during the ice cover period. Such greater releases as may be required for the needs of downstream interests shall be released as ordered by the Minister.

13. As and at the times requested by the Minister, the Licensee shall submit to the Minister, for his approval, a schedule of the proposed releases from, over, or through the several works, and the Minister may approve the schedules with or without variation; and subject to any order made under the Act, the Licensee shall comply with the schedules so approved.

14. The Licensee shall, to the satisfaction of the Minister, clear and keep clear, from timber, brush and other material, lands which are to be flooded.

15. Subject to Articles 10 and 11 hereof, but notwithstanding any other terms or conditions of this Interim License, the Licensee shall operate the Missi Falls and Notigi control structures in such a manner that:

    (a) Any increase or decrease in the rate of outflow through either structure during any 24 hour period shall not exceed 10,000 cubic feet per second, and,

    (b) The drawdown in water level in Southern Indian Lake during any 12 month period shall not exceed two feet, and,

    (c) The water level immediately upstream of the Notigi control structure shall not decline to less than elevation 838 feet.

16. The Licensee shall, as ordered by the Minister, post any "landing" or "refuge" station or stations established along the shorelines of the storage reservoirs maintained under authority of this Interim License on Southern Indian Lake and the Rat River.

17. The plans filed by the Licensee and made a part of this Interim License are as follows:

Manitoba Water Resources Branch File Number	Licensee's File Number	Description
60-1-1008	7001-E-59(Sht.1)(Rev.1)	Location plan and preliminary typical sections of control structures.
60-1-1007		Topographical map Southern Indian Lake and Rat River region.

18. Upon the satisfactory completion by the Licensee of the development in accordance with Article 3 hereof and upon the due observance and fulfilment by it of all the terms and conditions required by this Interim License, and under the Regulations and all amendments thereto as may be made from time to time, to be by it observed and fulfilled, the Minister shall and will issue in favour of the Licensee a Final License for the diversion and storage of water for the development of water power and for the use or occupation of those lands of the Province which, in the Minister's opinion, are required for the proper operation and maintenance of the works authorized. The said Final License shall be issued subject to the regulations then in force and shall embody such matters as the Minister may determine in accordance with the regulations.

19. All record plans filed with the Director and referred to in this Interim License are incorporated herewith and made a part hereof.

20. This Interim License is issued upon the express condition that it shall be subject to the provisions of the Regulations and all amendments thereto as may be made from time to time.

21. All elevations mentioned herein are based on Inland Waters Branch Bench Mark which is a brass cap set in bed rock 5 feet north and 11 feet west of the northwest corner of the Manitoba Government Air, Radio and Technical Services Division dock at the South Indian Lake Settlement. This Bench Mark defines elevation 839.58 feet.

Issued at Winnipeg this 11th day of May, A.D. 1973 at the direction of the Honourable Minister of Mines, Resources and Environmental Management.

Sidney Green

Minister of Mines, Resources and
Environmental Management

with the approval of the
Lieutenant Governor in Council.

APPENDIX 1 - G

LICENSE TO IMPOUND WATER ON SOUTHERN INDIAN LAKE AND RAT RIVER, DIVERT WATER FROM CHURCHILL RIVER TO NELSON RIVER, AND USE WATER FOR POWER PRODUCTION PURPOSES

LICENSE TO IMPOUND WATER ON SOUTHERN INDIAN LAKE AND RAT RIVER, DIVERT WATER FROM CHURCHILL RIVER TO NELSON RIVER, AND USE WATER FOR POWER PRODUCTION PURPOSES

by

Manitoba Department of Mines, Resources and Environmental Management
Winnipeg, Manitoba
August, 1973

DEPARTMENT OF MINES, RESOURCES AND ENVIRONMENTAL MANAGEMENT
WATER RESOURCES BRANCH

LICENCE TO IMPOUND, DIVERT AND USE WATER FOR POWER PRODUCTION PURPOSES

Issued in accordance with the provisions of
"THE WATER RIGHTS ACT"
and regulations made thereunder.

Licence No. 72-32.

Know all men by these presents that in consideration of and subject to the provisoes, conditions and restrictions hereinafter contained, the Minister of Mines, Resources and Environmental Management (hereinafter called "the Minister") for the Province of Manitoba does by these presents give full right and liberty, leave and licence to MANITOBA HYDRO (hereinafter called "the LICENSEE") to:

(a) impound water in Southern Indian Lake by means of dams and a control structure located on the Churchill River at Missi Falls at the outlets of Southern Indian Lake, and

(b) impound water in the Rat River System by means of a dam and control structure located on the Rat River near the outlet of Notigi Lake, and

(c) divert water from the Churchill River into the Nelson River via the Rat and Burntwood Rivers by means of a channel from South Bay on Southern Indian Lake to Issett Lake,

for power production purposes, the locations and details of the said dams, control structures and channel (hereinafter collectively called "the WORKS") being more particularly shown on a plan filed in the office of the Director General, Water Resources Branch as No. 60-1-1008, a copy of which plan is hereto attached and marked Exhibit "A".

This licence is issued upon the express condition that it shall be subject to the provisions of the Water Rights Act and Regulations and all amendments thereto and, without limiting the generality of the aforesaid, to the following terms and conditions, namely:

1. The water shall be impounded, diverted and used solely for power production purposes.
2. The WORKS shall be constructed in strict conformity with said Plan No. 60-1-1008 and shall be operated in accordance with the terms herein contained.
3. In the event that the rights of others are infringed upon and/or damage to the property of others is sustained as a result of the operation or maintenance of the WORKS and the rights herein granted, the LICENSEE shall be solely responsible and shall save harmless and fully indemnify Her Majesty the Queen in Right of the Province of Manitoba, from and against any liability to which Her Majesty may become liable by virtue of the issue of this Licence and anything done pursuant hereto.
4. This Licence is not assignable or transferable by the LICENSEE and when no longer required by the LICENSEE this Licence shall be returned to the Minister for cancellation.
5. Upon the execution of this Licence the LICENSEE hereby grants the Minister and/or his Agents the right of ingress and egress to and from the sites of the WORKS for the purpose of inspection of the WORKS and the LICENSEE shall at all times comply with such directions and/or orders that may be given by the Minister or his Agents in writing from time to time with regard to the operation and maintenance of the WORKS and appurtenances.
6. If for any reason whatsoever the Minister deems it advisable to cancel this Licence, he may do so by letter addressed to the LICENSEE at 820 Taylor Avenue, Winnipeg, Manitoba and thereafter this Licence shall be determined and at an end.
7. The term of this licence shall be thirty (30) years and this Licence shall become effective only on the date of execution hereof by a person so authorised in the Department of Mines, Resources and Environmental Management.
8. Subject to Items 10 and 13 hereof, and except as may be otherwise authorized by the Minister, the LICENSEE shall, during periods when the water level of Southern Indian Lake is above elevation 847 feet, operate the Missi Falls and Notigi control structures in such a manner as to effect the maximum discharge possible under the circumstances then prevailing until the water level of the said lake returns to elevation 847 feet.
9. Subject to Item 11 hereof, and except as may be otherwise authorized by the Minister, the LICENSEE shall regulate the water level of Southern Indian Lake so as to prevent the water level from receding below elevation 844 feet.

The LICENSEE shall not release more than an average weekly flow of 30,000 cubic feet per second through the Notigi control structure, and shall vary the magnitude of the release through that structure from time to time in order to ensure that the flow in the Burntwood River, as measured at the Provincial Government gauging station at Thompson, shall not exceed the average mean flow plus 30,000 cubic feet per second.

11. Releases from Missi Falls control structure shall not be less than 500 cubic feet per second during the open water period and 1500 cubic feet per second during the ice cover period. Such greater releases as may be required for the needs of downstream interests shall be released as ordered by the Minister.

12. As and at the times requested by the Minister, the LICENSEE shall submit to the Minister, for his approval, a schedule of the proposed releases from, over or through the Missi Falls and Notigi control structures, and the Minister may approve the schedules with or without variation; and the LICENSEE shall comply with the schedules so approved.

13. Subject to Items 9 and 10 hereof, but notwithstanding any other terms or conditions of this Licence, the LICENSEE shall operate the Missi Falls and Notigi control structures in such a manner that:

    (a) Any increase or decrease in the rate of outflow through either structure during any 24 hour period shall not exceed 10,000 cubic feet per second, and,

    (b) The drawdown in water level in Southern Indian Lake during any 12 month period shall not exceed two feet, and,

    (c) The water level immediately upstream of the Notigi control structure shall not decline to less than elevation 838 feet.

14. All elevations mentioned herein are based on Inland Waters Branch Bench Mark which is a brass cap set in bed rock 5 feet north and 11 feet west of the northwest corner of the Manitoba Government Air, Radio and Technical Services Division dock at the South Indian Lake Settlement. This Bench Mark defines elevation 839.58 feet.

In witness whereof I the undersigned hereby agree to accept the aforesaid Licence on the terms and conditions set forth therein and hereby set my hand and seal this 21st day of August A.D. 1973

MANITOBA HYDRO

Per:

~~Chairman~~ SECRETARY

Issued at the City of Winnipeg, in the Province of Manitoba, this 22nd day of Aug A.D. 1973

Original Signed By
SID GREEN, Minister

Minister of Mines, Resources and Environmental Management

APPENDIX 1 - H

APPROVAL OF THE CHURCHILL RIVER DIVERSION WORKS AND SITE - LOCATIONS

APPROVAL OF THE CHURCHILL RIVER DIVERSION WORKS AND SITE-LOCATIONS

issued by

Canada Ministry of Transport
Ottawa, Ontario
October, 1973

C A N A D A
MINISTRY OF TRANSPORT

FORM 1

NAVIGABLE WATERS PROTECTION ACT, PART I
Application in re: section 5(1) of the Act

8212-311 (C

APPROVAL

Applicant:	Manitoba Hydro, Box 815, Winnipeg, Manitoba. R3C 2P4
Work:	(a) control structure, (b) control structure, (c) diversion channel
Site - Location:	(a) at Missi Falls, on the Churchill River, in Township 96, Ranges 4 and 5; (b) at Notigi on the Rat River, in Township 79, Ranges 12 and 13; (c) from South Bay on Southern Indian Lake to Issett Lake, in Township 88, Ranges 10 and 11; all areas west of the Principal Meridian, in the Province of Manitoba.
IMPORTANT NOTICE:	This document is not a building permit under municipal law and does not constitute authority to occupy land.

WHEREAS the above-named applicant has made application to the Minister of Transport under the Navigable Waters Protection Act for approve of the above-described work at the above-referred to site in accordance with the plans submitted by the applicant;

WHEREAS it is considered advisable to approve the said work at the said site and plans thereof for a period of 50 years, subject to the following term(s) and condition(s):

1. The owner or person in possession must ensure to the satisfaction of the Minister that water levels in the Port of Churchill will be maintained throughout the present or any possible future lengthening of the shipping season satisfactory to meet the requirements of navigatio
2. The owner or person in possession must ensure to the satisfaction of the Minister that levels in the portion of the Churchill River from Goose Creek to Deer River will meet minimum natural flows.
3. The owner or person in possession will construct control structures at intervals at the mouth of lakes on the Churchill River downstream from Missi Falls where in the opinion of the Minister it becomes necessary to maintain the navigability of these lakes.
4. (a) The owner or person in possession must ensure proper clearing of land in the Nelson House area and in the area between Footprint Lake and Threepoint Lake in order that flooding will not interfere with existing navigation by the local population; and

   (b) ensure that clearing of land in the vicinity of South Indian Lake Village does not interfere with navigation.
5. In the event that standing trees become a navigational problem now or in the future, the Minister will require the owner or person in possession to perform further clearing action as directed.

....2

6. The owner or person in possession is required to remove debris of any nature which results from the actual construction or from the flooding of land or diversion waters in the total area encompassed by the overall project (Churchill River Diversion Project).

7. Finance the placing of obstruction markers and aids to navigation if deemed necessary by the Minister to ensure safety and the public right of navigation.

THEREFORE, the Minister of Transport, pursuant to the provisions of the Navigable Waters Protection Act, Revised Statutes of Canada, 1970, chapter N-19, hereby approves the said work at the said site and plans thereof for the period of time aforesaid providing:

(a) the construction of the work is commenced within six (6) months and completed within three (3) years of the date hereof;

(b) the work is built, placed and maintained in accordance with the plans, the Navigable Waters Works Regulations and the aforesaid term(s) and condition(s).

Ottawa,

Jmarchand

Jean Marchand,
Minister of Transport.

APPENDIX 1 - I

INTERIM LICENSE FOR THE DEVELOPMENT OF WATER POWER - MISSI FALLS SITE, CHURCHILL RIVER

INTERIM LICENSE FOR THE DEVELOPMENT OF WATER POWER - MISSI FALLS SITE, CHURCHILL RIVER

issued by

Manitoba Department of Mines, Resources and Environmental Management
Winnipeg, Manitoba
December, 1974

PROVINCE OF MANITOBA

DEPARTMENT OF MINES, RESOURCES AND ENVIRONMENTAL MANAGEMENT

WATER RESOURCES BRANCH

INTERIM LICENSE FOR THE DEVELOPMENT OF WATER POWER

Missi Falls Site, Churchill River

Issued in accordance with the provisions of the Water Power Act, Chapter W70, Revised Statutes of Manitoba, 1970, and amendments, and of the Regulations in force thereunder to govern the mode of granting and administering Provincial water-power rights.

WHEREAS Manitoba Hydro, a corporation duly incorporated by Act of the Legislature of the Province of Manitoba, and whose head office address is Box 815, Winnipeg 1, Manitoba, (hereinafter called "the Licensee"), by memorandum dated September 18, 1973, signed by J.F. Funnell, General Counsel and Secretary, and by other documents attached thereto, has filed with the Director General, Water Resources Branch (Director of the Water Resources Branch, hereinafter called "the Director") at Winnipeg an application for a license to divert and use water for the development of power at the Missi Falls site on the Churchill River; and,

WHEREAS Provincial water-powers and lands as defined in the Water Power Act, R.S.M. 1970, Cap. W70, (hereinafter called "the Act"), are required to be used or occupied by the Licensee in carrying out the undertaking for which this Interim License is granted, the nature of the said undertaking being the construction of a reinforced concrete powerhouse situated adjacent to the Missi Falls control structure (the Missi Falls control structure was authorized to be constructed by interim license for the diversion of water from the Churchill River to the Nelson River, and the impoundment of water on the Rat River and Southern Indian Lake); an intake channel; a tailrace channel; and all necessary machinery and equipment required for the development, generation, and use of electric power for local use at the Missi Falls control structure and site, as shown or described more particularly by means of the record plans and data filed with the Director, as specified hereinafter; and,

WHEREAS the Licensee has fully complied with the requirements of the Manitoba Water Power Regulations, being Manitoba Regulation 95/45 and all amendments thereto (hereinafter called "the Regulations"), insofar as it is required for the issue to the Licensee of this Interim License; and, WHEREAS the Licensee has duly executed an acceptance of the terms and conditions of this Interim License and has undertaken to observe and fulfil all the terms and conditions which under this Interim License and under the Regulations the Licensee is required to observe or fulfil;

NOW THEREFORE, under authority of and subject to the provisions of the Act and Regulations, this Interim License is issued, granting to the Licensee:

(a) The right to divert and use waters of the Churchill River at the Missi Falls site,

(b) The right to develop electric power and energy from the said waters,

(c) The right to generate and use the said electric power and energy and for that purpose to use and occupy the lands of the Province hereinafter described, and

(d) The right to construct, operate and maintain the undertaking, the location and description of which are shown upon the record plans numbered and filed in the office of the Director at Winnipeg, except as the said undertaking may be modified or extended with the prior approval of the Minister of Mines, Resources and Environmental Management (hereinafter called "the Minister").

Subject, nevertheless, to the provisions of the Regulations and of any other regulations now or hereinafter in force governing the granting or administering of Provincial water-powers and the lands required in connection with the development and use thereof, and to the following special terms and conditions, namely:

1. The Licensee shall file the general construction plans of the undertaking authorized hereby with the Director in such form and detail as is required by the Regulations within three (3) months from the date of this Interim License.

2. After the general construction plans have been approved, the Licensee shall begin the construction of the undertaking authorized hereby within the time limit provided in the Regulations, and shall thereafter without interruption, except such as may be occasioned by act of God or other major cause beyond the control of the said Licensee (other than want of funds), carry on and

complete the construction of the said undertaking according to the plans so approved or as the same may be amended or modified at the direction and with prior approval of the Minister during the progress of construction, and subject to the terms of this Interim License and of the Regulations.

3. Subject to Article 1 hereof, the Licensee may enter upon, use and occupy for making surveys and investigations and constructing works as may be deemed necessary for the undertaking, such lands of the Province as may reasonably be required for the said purposes provided that, when so requested in writing by the Director, following completion of the works and the commencement of the production of power, the Licensee shall cause a survey to be made and a plan prepared by a Manitoba Land Surveyor showing in detail the lands required to be occupied for the works. Such survey shall be limited to include only such areas for the said purpose as the Director may approve and shall be prepared in accordance with Section 24 of the Regulations.

4. Within three (3) years from the date of this Interim License, the Licensee shall have satisfactorily completed the undertaking and shall have installed all the machinery and equipment required for an initial development of one turbine generator unit having a capacity of three hundred and seventy (370) horsepower, measured on the turbine shaft, and shall be in a position to apply the power to beneficial use.

5. The Licensee shall notify the Director in writing of the commissioning date of the turbine generator unit within 30 days of commissioning. The Director shall, in accordance with the provisions of Subsection (4) of Section 42 of the Regulations, determine a date which, for the purpose of the Interim License and Regulations, shall be the date of completion of the initial development and shall be the earlier of:

   (a) the date on which the turbine generator unit comprising the initial development has been commissioned; or

   (b) the date fixed in Article 4 hereof as the limiting date by which the initial development is to be completed, whether the same shall have been completed or not.

6. The Licensee may divert and use continuously at the said Missi Falls site all the water of the Churchill River which may be required for the development of power at the rate of 370 horsepower at the said site from time to time during the term of this Interim License, subject, however, to the provisions of Section 72 of the Regulations.

7. The Licensee shall pay a rental for the use and occupation of Crown Lands required for the purposes described in Article 3 hereof in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.

8. From the date of completion of the initial development determined in accordance with Article 5 hereof, and during the remaining term of this Interim License, the Licensee shall pay annually, in arrears, as rental for water used in the development of power, an amount determined in accordance with the principles set out in Section 48 of the Regulations in force or as may be amended in the future, being whichever is the greater of:

   (a) A rental at the rate of fifty (50) cents per installed horsepower of turbine capacity, based on the initial development of 370 horsepower; or

   (b) A rental at the rate of one dollar and twenty-five cents ($1.25) per horsepower-year of output measured on the turbine shaft, such output to be calculated in the manner provided in Subsection (9) of Section 48, of the Regulations.

The first payment of annual water rental is to be for that part of the year between the date of completion of the initial development determined in accordance with Article 5 hereof, and the end of the then current calendar year. Subsequent payments are to be for each successive calendar year, or part thereof, during which the Licensee continues operations. In each case the Licensee shall, on or before the first day of March in each year following any calendar year for which rental is payable, submit all data required by the Director for the determination of its rental for the preceding calendar year. The Director shall thereupon prepare and submit to the Licensee a statement of the rental due. Payment shall be made within sixty (60) days of submission of the said statements; otherwise the penalties provided in Subsection (4) and (6) inclusive of Section 48 of the Regulations shall apply.

9. The plans filed by the Licensee and made a part of this Interim License are as follows:

Manitoba Water Resources Branch File Number	Licensee's File Number	Description
61-6-1043	7001-D-83 (Sheet 1) (Rev.0)	Location plan, preliminary plan and section of water-power development at Missi Falls

10. Upon the satisfactory completion by the Licensee of the initial development in accordance with Article 4 hereof and upon the due observance and fulfilment by it of all the terms and conditions required by this Interim License and under the Regulations to be by it observed and fulfilled, the Minister shall and will issue in favour of the Licensee a Final License for the use of water, for the development of energy therefrom, for the utilization of such energy, and for the use or occupation of those lands of the Province which, in the Minister's opinion, are required for the proper operation and maintenance of the works authorized. The said Final License shall be issued subject to the regulations then in force and shall embody such matters as the Minister may determine in accordance with the Regulations, and the following terms and conditions, namely:

(a) The Licensee may divert and use continuously at the said Missi Falls site all the water of the Churchill River which may be required for the development of power at the rate of 370 horsepower at the said site during the term of this Final License, subject, however, to the provisions of Section 72 of the Regulations.

(b) The Licensee shall, during the term of the Final License pay a rental for the use and occupation of Crown lands required for the purposes described in Article 3 of the Interim License, in such amounts or at such rates as may be fixed by the Lieutenant Governor in Council.

(c) The Licensee shall also pay an annual rental during the term of the Final License for the use of water for the development of power, determined in accordance with the principles set out in Section 46 of the Regulations in force or as may be amended in the future, and payable at the times and in the manner therein provided, and at the following rates:

(i) The rentals in the twenty-year period directly following the date of completion of the initial development determined in accordance with Article 5 hereof shall be the greater of:

(a) An annual rental of fifty (50) cents per installed horsepower;

(b) An annual rental of one dollar and twenty-five cents ($1.25) per horsepower year.

(ii) The annual rental to be paid after the expiry of the said twenty-year period shall be determined as provided in the regulations in force at such time.

(d) The undertaking in respect of which the Final License is to be issued is to comprise: a reinforced concrete powerhouse with one turbine generator unit having a capacity of 370 horsepower; an intake channel; a tailrace channel; and all plant machinery and equipment required for the development and utilization of the power at the rate of 370 horsepower at the said Missi Falls site, together with such other approved works as have been constructed for purposes of the undertaking for which the Final License is to be issued.

(e) The energy developed under the said Final License may be generated and used for local use at the Missi Falls control structure and site.

(f) In accordance with Section 45 of the Regulations the term of the Final License shall be fifty (50) years from and after the date fixed in accordance with Article 5 of the Interim License for the completion of the initial development and shall be subject to renewal or extension in accordance with the provisions of the Laws and Regulations relating thereto and then in force.

(g) The Severance Line as defined in Section 1 of the Regulations shall be a line circumscribing the land area required to be occupied by the works authorised under this Interim License.

11. All record plans filed with the Director and referred to in this Interim License are incorporated herewith and made a part hereof.

12. This Interim License is issued upon the express condition that it shall be subject to the provisions of the Regulations and all amendments thereto.

Issued at Winnipeg this 13th day of December A.D., 1974 at the direction of the Honourable Minister of Mines, Resources and Environmental Management.

Sidney Green

Minister

APPENDIX 1 - J

PROGRESS REPORT
NUMBER 1
DECEMBER 31, 1971

PROGRESS REPORT
NUMBER 1
DECEMBER 31, 1971

by

The Lake Winnipeg, Churchill and Nelson Rivers Study Board
Winnipeg, Manitoba
December, 1971

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LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS

BASIN STUDY

I. SYNOPSIS

The Canada Water Act, 1970, provided for Canada and the Provinces to jointly participate in research, planning and implementation of programs relating to the conservation, development and utilization of water resources. A Canada-Manitoba Advisory Committee on Water established under this Act gave top priority in its considerations to diversion from the Churchill River and regulation of Lake Winnipeg for power purposes on the Nelson River. A Canada-Manitoba Study Agreement was prepared authorizing studies to determine the effects Lake Winnipeg regulation, Churchill River diversion, and development of hydro-electric potential of the Churchill River diversion route are likely to have on other resources and related uses and to make recommendations for enhancing the over-all benefits with due consideration for the protection of the environment. The Agreement received final approval in September, 1971.

Although the Agreement provides for a progress report by December 31, 1971, work undertaken to date has been limited because of the delayed signing of the Agreement which did not occur until September 9, 1971. Nevertheless, some progress has been made. The Board has held four meetings and conducted a Study seminar in the latter part of November, 1971. A Study Director was appointed and assumed duties December 1, 1971.

The Board has considered modifications and additions to the proposed outlet control works for Lake Winnipeg to provide for a fishway and ship-locking facilities. With the following exception, no specific recommendations can be made in this regard at this time. The Board recommends that the control works provide for an experimental fish compartment which could serve as the basal component of a future fishway.

Studies have been initiated in respect to erosion, sedimentation, and recreation. The Board proposes other studies in the area of the Lake Winnipeg outlet control works to begin as soon as possible. These include studies of the effect of dredge spoil material on wildlife habitat, shoreline ecology and water quality; an evaluation of Kiskitto Lake and surrounding habitat for wildlife to maximize benefits from controlled water levels in this area; and, socio-economic studies of communities located in close proximity to the control works giving particular attention to potential transportation benefits resulting from Manitoba Hydro's construction and access routes to control structures.

The Board expects to assign top priority to those activities necessary for study development and programming early in 1972; the study to be developed and programmed recognizing individual study components within geographical areas, time constraints and the capability of participating agencies.

II. STUDY BACKGROUND

Development of Study Agreement

In 1963 and 1964, Canada and Manitoba entered into agreements for joint studies of the power potential and a development program for the Nelson River. Based on recommendations from these studies, the two Governments entered into a further agreement in 1966 to proceed with the facilities necessary to develop the hydro-electric potential of the Nelson River. On February 15, 1966, Canada agreed to build a transmission system as its contribution to a Phase I Development program to be leased to Manitoba during the agreed upon repayment period. Manitoba assumed responsibility for a dam and generating station at Kettle Rapids; a control dam, diversion structure and ancillary works for storing and releasing water from the Churchill River at Southern Indian Lake into the Nelson River; and a control dam, spillway and flood control works to regulate the outflows from Lake Winnipeg. Construction of part of the transmission system has been completed and four of the twelve units planned for the Kettle station are now producing power.

In April, 1968, Manitoba Hydro applied for a license to proceed with a "high level" diversion from Southern Indian Lake. This proposed diversion scheme was not acceptable because of the degree of anticipated environmental damage.

At the request of the Manitoba Government, Manitoba Hydro reassessed its proposed scheme for power development. Two studies were commissioned to investigate the energy-resource aspects of regulating Lake Winnipeg and to appraise alternative diversions from the Churchill River. The consultants also reported briefly on the impact of alternate schemes for power development on other resources but these data were incomplete and suggested the need for further research.

The Canada-Manitoba Advisory Committee on Water established under the Canada Water Act directed a task force to outline a comprehensive resource study of the area embracing Lake Winnipeg, the Nelson River, the Saskatchewan River east of Cumberland Lake, and the Churchill River. The task force recommended framework and project-feasibility studies. These studies were considered too broad in scope at this time and with further direction from the Advisory Committee, a working group including Saskatchewan representatives was organized to draft a joint study agreement restricted specifically to water resource considerations. Later, Saskatchewan withdrew from the working group.

On September 23, 1970 Manitoba Hydro and the Province of Manitoba announced the broad principles governing the regulation of Lake Winnipeg water levels and diversion of the Churchill River to the Nelson River. As Hydro proposed to effect the necessary control of Lake Winnipeg by the fall of 1974 and to follow with the Churchill diversion in 1975 or 1976, this afforded a three year period for a study of environmental implications and the social consequences resulting from the proposed water regulation and diversion.

On the basis of the study agreement drafted by the working group, the Canada-Manitoba Advisory Committee recommended a study of the impact of the proposed diversion and regulation works on other resources based on the criteria for flows and regulation range described by the Manitoba policy statement on Hydro development for the Nelson River. The Lake Winnipeg, Churchill and Nelson Rivers study agreement was signed on September 9, 1971.

Proposed Manitoba Hydro Development

Manitoba Hydro's proposed sequence for power development involves, respectively, Lake Winnipeg regulation and Churchill River diversion from Southern Indian Lake to the Nelson River. Lake Winnipeg will be regulated between the levels of 711 and 715 feet by improved outlet capacity and a control structure. The cost of these works is estimated to be $50 million. Manitoba Hydro has received an interim license to proceed with Lake Winnipeg regulation.

With controlled storage in, and increased outlet capacity from, Lake Winnipeg, a "mid level" diversion of the Churchill River from Southern Indian Lake has been proposed, the lake not to exceed the 850 foot level. It is further proposed that the capacity of the diversion from Southern Indian Lake will not exceed 30,000 cfs. The decision to proceed first with Lake Winnipeg regulation provides more time for Manitoba Hydro to review all possible alternatives for the Churchill River diversion.

Manitoba Hydro's proposals and the consequent changes to Lake Winnipeg, the Churchill and Nelson Rivers may be described briefly as follows:

> Lake Winnipeg Regulation: The outlet capacity of Lake Winnipeg will be increased and a control structure will be installed at Jenpeg on the West Channel of the Nelson River to regulate the lake. This change in outlet configuration and pattern of outflow will alter the pattern of Lake Winnipeg levels from those that would occur without regulation. The pattern of levels will also be altered in the chain of lakes between Lake Winnipeg and the Jenpeg control structure (hereafter referred to as the outlet lakes).

Nelson River: The flow pattern and hence fluctuation of water levels above and below the Jenpeg control structure will be altered by Lake Winnipeg regulation. Proposed hydro-electric plants on the lower portion of the Nelson River will create headponds in portions of the river channel causing flooding and creation of new shorelines. However, although the development of these hydro-electric plants will affect other resources, investigations of these effects are not included in this Agreement. Increased flows in the Nelson River at Split Lake will result from diversion of the Churchill River creating further changes to the pattern of flows in the lower Nelson River as well as alteration of water quality.

Churchill River: The proposed diversion will alter the quantity and pattern of flow in the Churchill River downstream from the point of diversion and, consequently, the pattern of water level fluctuation. In addition, the diversion may require raising of water levels resulting in flooding and formation of new shorelines in the Churchill River system and will result in flooding along the diversion route.

Burntwood River and/or Alternate Diversion Systems: Diversion of the Churchill River will introduce additional water to the Rat and Burntwood Rivers and/or alternate diversion routes. This will greatly increase flows in these streams and alter the water levels in the stream channels. The pattern of flows, water level fluctuations and water quality will also be significantly changed in these rivers. In addition, proposed hydro-electric power projects along the diversion route will flood land and form new shorelines in headpond areas.

III. RESOURCE STUDIES PRECEEDING STUDY AGREEMENT

During 1967-70, a number of agencies recognized the need for a multi-discipline approach to water resource development in northern Manitoba, and, consequently, a number of studies and reports have been completed documenting anticipated effects of alternative developments on natural resources and social values. While details of these studies are too voluminous to include in this report, titles, authorship, dates, and general comments are presented in Table 1.

Other studies were recently initiated in anticipation of an approved study agreement. The Manitoba Government recognized an immediate need for studies concerning the proposed regulation and diversion works associated with future power developments on the Nelson River and has implemented the following investigations:

Lake Winnipeg Recreation Study

A study to assess the significance of Lake Winnipeg to recreation demand has been implemented by the Manitoba Department of Tourism, Recreation and Cultural Affairs. Specific objectives of the study are to determine the present demand for recreation on Lake Winnipeg, describe the inter-relationship between the existing demand and supply of recreation opportunities, and to forecast future recreation demand for Lake Winnipeg. This information will help to relate recreational opportunities and effects of Lake Winnipeg regulation. Survey-interview work has been completed, computer analyses of data is anticipated during early January, 1972, and a report will be forthcoming about the end of the present fiscal year.

TABLE I TITLES, AUTHORSHIP, DATE AND COMMENTS ON REPORTS DESCRIBING SOCIAL AND RESOURCE IMPLICATIONS OF THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS DIVERSION.

TITLE	AUTHORSHIP	DATE	COMMENTS
Possible Changes in the Natural Resources of Southern Indian Lake as a result of the Churchill River Diversion	Welch, H.E., Stewart, K.W. and Y.M. Barber, Jr.	1966	Restricted to fish and wildlife implications.
Reconnaissance Study of the effect on Human and Natural Resources of the Churchill River Diversion Plans	H.E. Duckworth and Colleagues, Univ. of Manitoba.	1967	- study initiated by Manitoba provincial government. - constituted a "Reconnaissance Study" during summer and fall of 1966. - recommended no increase in Southern Indian Lake level, re-examination of diversionary scheme by Manitoba Hydro and initiation of non-energy resource studies.
Transition in the North	Van Ginkel Associates and Hedlin, Menzies and Associates Ltd.	1967	- study initiated by Manitoba Development Authority. - gives primary attention to impact of power development on northern communities.
Resource Implications of the Churchill River Diversion	Resources "Task Force" Manitoba Dept. of Mines and Natural Resources	1968	- study initiated by Manitoba provincial government. - emphasis on multi-resource effects and need for multi-resource study.
Lake Winnipeg Regulation	C. Booy Manitoba Water Commission	1969	- initiated by Manitoba provincial government.

TITLE	AUTHORSHIP	DATE	COMMENTS
			- purpose: to study all pertinent aspects of Lake Winnipeg regulations and recommend the most practical regulatory range.
Province of Manitoba, Dept. of Mines and Natural Resources, Water Control and Conservation Branch: Report on Lake Winnipeg Regulation.	G.E. Crippen & Associates Ltd.	1970	- study initiated by Manitoba Government. - studies concerning physical and economic feasibility of the regulation of Lake Winnipeg as a multi-purpose reservoir. - alternative regulatory schemes were studied.
Manitoba Hydro, Churchill River Diversion, Study of Alternative Diversions.	Underwood, McLellan & Associates Ltd.	1970	- studies initiated by Manitoba Hydro. - alternative Churchill River diversion schemes described. - reported effects of diversion on water and related resources. - economic, social, and engineering aspects considered in terms of benefit-cost.
Task Force Report on Proposed Study of Lake Winnipeg, Nelson and Churchill Rivers.	Canada-Manitoba Advisory Committee on Water	1970	- initiated by federal and provincial government. - primary objective to outline a comprehensive study of all aspects related to water resources development in the region embracing Lake Winnipeg, Nelson River, Saskatchewan River east of Cumberland Lake and the Churchill River basin. - describes resource and social implications related to water resource development.

Lake Winnipeg Shoreline Erosion and Sand Movement Study

A study has been undertaken to determine the distribution and rate of shoreline erosion and the characteristics of sand movement along the shoreline of the southern portion of Lake Winnipeg. Further, the study is proposed to relate erosion and sand movement to causative factors in order to determine measures by which to alleviate harmful effects and recommend mitigation procedures.

The study is being conducted by the Manitoba Water Resources Branch. Progress to date includes, sampling and testing of offshore lake bottom soils, beach and offshore lake surveys to determine cross-section reference for evaluating erosion and deposition, establishment of wind and wave recording instruments, and aerial photography. Information from this study will greatly assist in the interpretation of effects of Lake Winnipeg regulation on shoreline characteristics.

Northern Manitoba Recreation Study

The Manitoba Provincial Parks Branch of the Department of Tourism, Recreation and Cultural Affairs has indicated the need for inventory and assessment of the recreational resources and potential within the areas of influence of the Churchill River diversion scheme. Staff have been engaged to conduct the study.

IV. LAKE WINNIPEG REGULATION AND PUBLIC MEETINGS

In November, 1970, the Province of Manitoba granted Manitoba Hydro an interim license to regulate Lake Winnipeg between 711 and 715 feet. The Manitoba Government agreed to conduct public meetings to permit those interests affected and other interested people to obtain more detailed and supplementary information concerning Lake Winnipeg regulation - studies relative to beach erosion, resource development, existing flood compensation program, etc. These meetings would also assist the Manitoba Government to receive public opinions and information pertinent to Lake Winnipeg regulation. Such information could be of considerable value to the Lake Winnipeg Management Board in future decisions respecting Lake Winnipeg regulation.

The Manitoba Water Commission, an advisory body to the Minister, Manitoba Department of Mines, Resources and Environmental Management, is responsible for determining and recommending to the Minister the most acceptable and practical range of regulation of Lake Winnipeg water levels in the best social and economic interests of the people of the Province. To further this end, the Commission reported the effects of Lake Winnipeg regulation on Lake Winnipeg and Cross Lake water levels and, on the basis of this information, requested various resource personnel to evaluate the effect of Lake Winnipeg regulation on their respective disciplines. Thirteen reports were prepared for the Commission. These reports portray the need for precise and accurate data to correctly interpret the effect of Lake Winnipeg water levels and flows on related resources, e.g., shoreline and peripheral marsh wildlife habitat.

In September, 1971, the Manitoba Government formed the Lake Winnipeg Management Board for the purpose of achieving multi-disciplinary use of the Lake. In this connection, the Board will be responsible for establishing parameters for the pattern of regulation of Lake Winnipeg. The Board comprises senior officials of the Department of Mines, Resources and Environmental Management, the Department of Tourism, Recreation and Cultural Affairs, the Department of Municipal Affairs, the Department of Agriculture, and Manitoba Hydro. At the request of the Board, the resource-effect reports forwarded to the Water Commission are presently being revised, edited and consolidated with information from Manitoba Hydro into a report describing anticipated effects of Lake Winnipeg regulation. The report will be made available to interested persons prior to the public meetings scheduled for February, 1972.

V. PROGRESS SUBSEQUENT TO SIGNING OF STUDY AGREEMENT

Study Board

Following signing of the agreement, a Study Board comprised of the following members was appointed to administer the study:

Canada	Manitoba
Mr. N.H. James	Mr. N. Mudry, Chairman
Mr. E.W. Humphrys	Mr. C.J. Goodwin
Dr. D.A. Munro	Dr. K.H. Doan

The Study Board (hereafter referred to as the Board) will be responsible for directing the study and will report to the Minister of the Environment of Canada and the Minister of Mines, Resources and Environmental Management of Manitoba. The Board has held four meetings.

Advisory Committee

A technical Advisory Committee consisting of two members from each government has been appointed by the Board to assist and advise the Study Director in the development and co-ordination of the study program.

The Technical Advisory Committee comprises the following members:

Canada	Manitoba
Dr. J.R. Vallentyne	Mr. H.C. McKay
Mr. G.S. Brown	Mr. K. Renger

Study Director

The Board has appointed Dr. I.W. Dickson to the position of Study Director. Dr. Dickson was born and educated in Manitoba. He has been associated with the Manitoba Department of Mines, Resources and Environmental Management since 1957 in research and planning in a wide area of natural resource projects and has served as senior fisheries planner for the past two years. He received his Ph.D. in Fisheries Biology from the Department of Natural Resources, Utah State University, Logan, Utah in 1968.

Information Seminar

The Board held an information seminar in Winnipeg on November 22 and 23, 1971 to aid in the development of the study program and to identify those resources available for suitable conduct of the study. The seminar was attended by approximately eighty federal, provincial and university representatives from about fifteen different agencies. This provided an excellent opportunity for the Study Director to become acquainted with many of the people to be engaged in the study. Summary reports of the seminar workshop have been forwarded to the Board outlining areas to be considered for inclusion in the study, cost estimates associated with particular activities, and suitable agencies and staffing for the conduct of the various study components. Results of the seminar should provide considerable direction and assistance in the formulation of the study program. The Board wishes to acknowledge the contributions made by all participants.

Short-term Considerations

Since the signing of the Agreement, the Board has given immediate attention and high priority to those activities which may lead to recommendations for modifications or additions to design of the Lake Winnipeg control works. This priority has been established because of the proposed timing of the design and construction of the Lake Winnipeg control works. Attention has been focused on two key areas: (a) acquisition of information pertinent to control-works design and modification, and (b) studies of social and resource aspects to be affected by construction of the control works and development in the immediate future.

(a) Outlet control-works design and modification:

The Study Board has recognized two major concerns that could influence the design of proposed control works for Lake Winnipeg regulation. In the interests of fisheries and transportation, fishways and navigation locks are being considered as part of the outlet control works.

Fishways: Federal and Provincial fisheries authorities have examined the implications of the control works to fisheries in the area of the outlet lakes. In view of these considerations, it has been recommended that the lower portion of a fishladder be incorporated into the control works. Future studies will identify the significance of a fishway to fish migrations in this area, and, if necessary, the fishway may be completed at a later date to facilitate movement of fish through the control works.

Navigation locks: The construction of Lake Winnipeg control works could offer significant benefits to a more efficient transportation system for communities in the outlet lakes area. Pending further study, therefore, navigation locks should be considered in the design of the outlet control works. Such an addition to the works could produce significant and long-term benefits for future transportation systems to communities in this northern area.

(b) Social and resource studies:

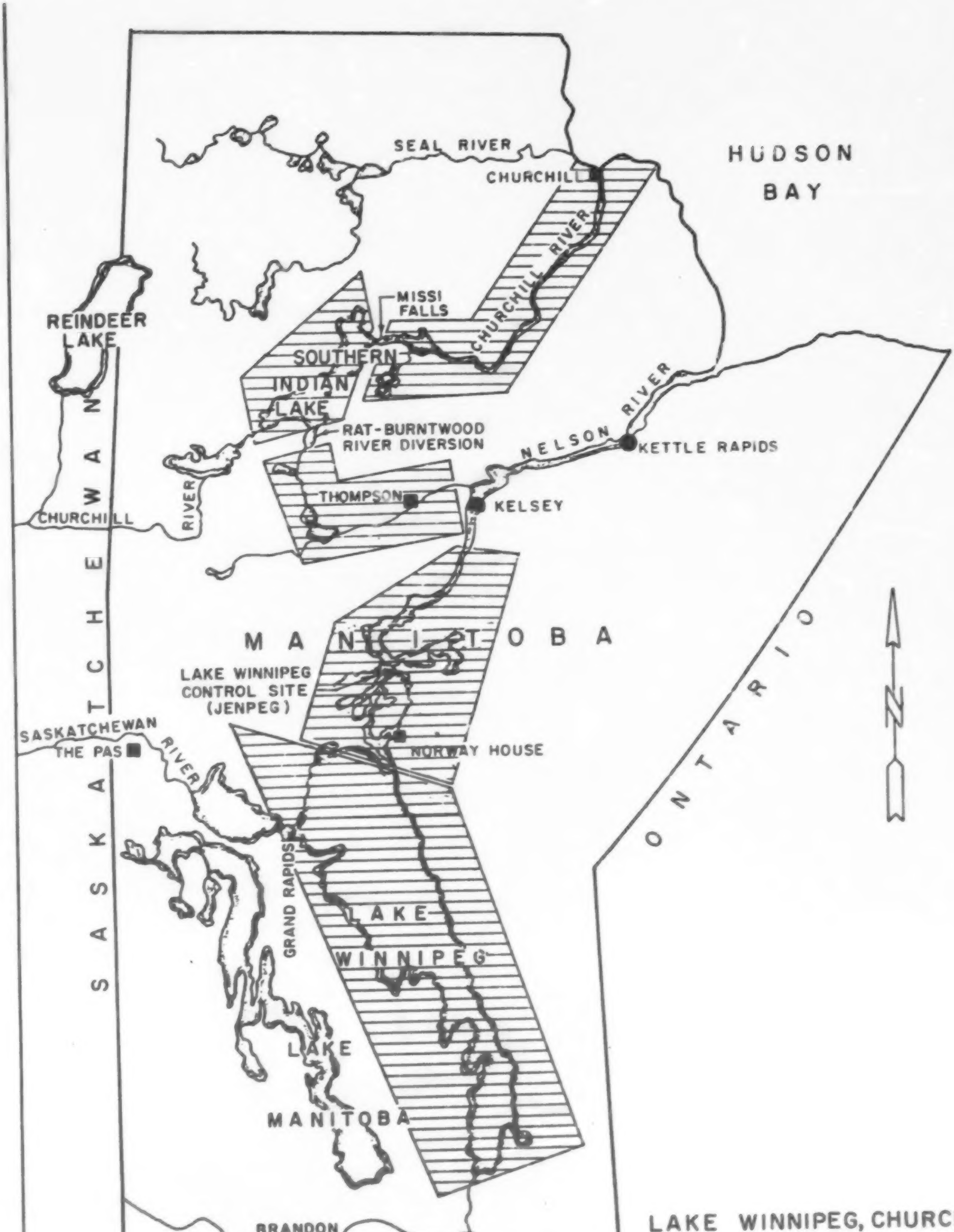
The Board has identified the need for a study of the effect of channel dredging at the Lake Winnipeg outlet on wildlife habitat, shoreline ecology and water quality. This study will be undertaken with a view to minimizing any adverse effect produced by the dredged material.

The need for a study of Kiskitto Lake and surrounding habitat has been identified to determine possible benefits to wildlife resulting from new water levels and flows through the outlet lakes.

A study of the socio-economic impact on communities located in the area of the Lake Winnipeg outlet control works will be initiated as soon as possible, particularly having regard for improved transportation systems in the area resulting from Manitoba Hydro's project.

Long-term Considerations:

(a) Study Areas: Five specific geographical areas may be identified for the purpose of the study. These are (1) Lake Winnipeg (2) outlet lakes area of Lake Winnipeg (3) Southern Indian Lake (4) Churchill River downstream from Southern Indian Lake, and (5) the Burntwood-Rat Rivers or alternate diversion route (Figure 1). At this time, the outlet lakes area is considered to have top priority in terms of implementation of the study program. However, priorities, timing and phasing are subject to change depending on the nature of individual study components and the geographic area for investigation.



LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY AREA

FILE NO. M-349

FIGURE 1

(b) Study Components: As a consequence of numerous meetings, earlier submissions, and studies identified at the seminar workshop, the Board is considering the following major components for inclusion in the study: recreation, archeology, social studies, transportation, fisheries and limnology, flood control, water supply, water quality, navigation, erosion, sedimentation, mapping, water levels and flows, wildlife, forestry, agriculture, and mining. Each one of these components has specific significance and priority in each of the five aforesaid study areas. In some cases, adequate data currently exists to describe resource and social effects for a particular component in a specific study area. However, in most instances, studies have been implemented in accordance with immediate demands and priorities identified by the Board. In the majority of cases, however, planning and programming of individual study components is required for early initiation of studies in 1972.

(c) Planning and Programming of Study Components: The Board, jointly with the Advisory Committee, Study Director, and other professionals in a wide range of disciplines will be particularly concerned with planning and programming study components early in 1972. The early development of an approved study program and initiation of studies during the 1972 field season is of utmost importance to the success of the study.

While relatively little progress has been made in program formulation, an example of the general order for sequential development and programming of the study may be described as follows:

1. Identification of project areas, i.e., Lake Winnipeg, Southern Indian Lake, Burntwood-Rat River system, etc.

2. Identification and categorization of data requirements.
3. Association of data requirements with specific project areas.
4. Identification of specific study components for individual project areas, i.e., forestry, mining, fisheries, etc.
5. Establishment of priorities of individual study components and activities according to their significance to the study objectives, costs, and associated time constraints.
6. Description of study flow chart illustrating general sequence for data collection and analysis.
7. Detailed scheduling of study program by individual components and activities.

Further reports by the Board will be made as specific concerns are identified and in accordance with the Study Agreement.

APPENDIX 1 - K

PROGRESS REPORT
NUMBER 2
DECEMBER 31, 1972

PROGRESS REPORT
NUMBER 2
DECEMBER 31, 1972

by

The Lake Winnipeg, Churchill and Nelson Rivers Study Board
Winnipeg, Manitoba
December, 1972

c/o Water Planning & Management Branch,
Environment Canada,
No. 8, Temporary Building,
OTTAWA, Ontario.

February, 1973.

The Honourable Jack Davis,
Minister, Environment Canada,
OTTAWA, Canada.

The Honourable Sidney Green, Q.C.,
Minister, Manitoba Department of Mines,
Resources and Environmental Management,
WINNIPEG, Manitoba.

Mr. L. A. Bateman, P. Eng.,
Chairman, Manitoba Hydro,
WINNIPEG, Manitoba.

Gentlemen:

I am pleased to present the second Progress Report of the Lake Winnipeg, Churchill and Nelson Rivers Study Board. The majority of investigations required by the Study were implemented this year and these are in various stages of completion. Satisfactory progress can be reported for these areas. More than 90% of the Study funds have been allocated to activities and studies.

Recommendations and issues as determined from studies to date are contained in the first part of the report. However, it might be noted that concerns arising from these studies have been brought to the attention of Manitoba Hydro as they have become known. The main body of the report outlines the scope of the Study and the objectives and also summarizes the scheduling, progress and completion dates of individual investigations. In addition, organizational, administrative and budgetary matters are briefly described.

It must be noted that while many of the studies initiated during 1972 are still in progress, results of progress to date in some areas are significant. These results have been highlighted for your attention.

Yours sincerely,

N. H. James,
Chairman.

RECOMMENDATIONS

1. Altered stream flows in the Burntwood River in the immediate vicinity of Thompson (Fig. 4) may adversely affect real property such as docking and other facilities associated with air transportation, the water supply pumping station, sewer outfall, boat mooring facilities and an undeveloped portion of the Thompson cemetery. It is recommended that Manitoba Hydro explore these in further detail.

2. As a result of flooding from the proposed Manasan power development, protection of the Thompson - Lynn Lake Highway will be required (Fig. 4). It is recommended that Manitoba Hydro take this into consideration.

3. A renovation program of fish station facilities at Southern Indian Lake has been initiated by the South Indian Lake Fisheries Cooperative Limited. It is recommended that appropriate government agencies, Manitoba Hydro and the South Indian Lake Fisheries Cooperative Limited maintain close liaison to ensure that new and/or renovated fisheries facilities, e.g. fish stations, are not located in areas to be flooded or made unnavigable.

4. The following general locations have been identified as potential recreational areas and should be given consideration in

parks and recreational site planning and development:

(a) South end of Notigi Lake; Rat River; Wapisu Lake; Manasan Falls to Thompson (Burntwood River); Thompson townsite to First Rapids (Burntwood River); Leaf Rapids to South Bay (Churchill River) (Fig. 4).

(b) Lower West Channel of the Nelson River (Jenpeg area); South end of Cross Lake; East Channel of the Nelson River to Sugar Falls (Fig. 3).

Within these general locations, to date, three specific recreational sites have been identified. Recommendations concerning specific recreation site developments are as follows:

(1) The area adjacent to the Rat River in the vicinity of Notigi Lake control structure and Highway #391 has recreational potential. Construction should proceed in a manner which will preserve the area below the Notigi dam to the north of Wapisu Lake for recreation (Fig. 4).

(2) The vicinity of the Minago River crossing of the Jenpeg road should be protected from intrusions for gravel and borrow pits (Fig. 3).

(3) Decisions regarding Manitoba Hydro's plans for the East Channel should reflect concern for preservation of the recreational potential of this area.

ISSUES

1. Eight-mile Channel Dredging Operation (Fig. 3).

Manitoba Hydro's dredging operation in the Eight-mile Channel has been identified as contributing to change in the environment which may be detrimental to some fish and wildlife resources. Studies to date have revealed the need for further information regarding water quality changes, dredge spoil distribution and accumulation and dyking requirements. Board studies will give further attention to these site specific aspects and appropriate recommendations will be forthcoming.

2. Kiskitto Lake Regulation and Control (Fig. 3).

Manitoba Hydro has proposed a plan for the regulation of Kiskitto Lake involving a Kiskitto-Minago drainage channel and control and Kiskitto Lake inlet works. These works will alter not only Kiskitto Lake water levels but also the rate of change of lake water levels. These altered water levels may affect the water quality of Kiskitto Lake. Further, the preferred patterns of regulation for fisheries and wildlife may not be compatible.

These areas will be investigated further by the Board and appropriate remedial measures recommended.

3. Nelson River East Channel Control Works (Fig. 3).

Manitoba Hydro has informed the Board of preliminary plans to construct control works by which to regulate flows in the East Channel of the Nelson River. Manitoba Hydro's stage of planning for this facility allows for a joint examination of Hydro plans and alternatives by Board Study participants and Manitoba Hydro. The Board supports and places high priority on a multi-discipline joint planning study involving Manitoba Hydro and Board Study participants in a review of the proposed East Channel control works.

4. Timber Clearing.

Timber clearing associated with proposed Manitoba Hydro power developments has been identified as an important issue by the Board. The Board has commissioned a report by which to identify general guidelines for timber clearing. Recommendations from this report will be forwarded to the Ministers and Manitoba Hydro as they are received.

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INTRODUCTION

This report constitutes a review and summary of the Board's activities and progress in the conduct of the Lake Winnipeg, Churchill and Nelson Rivers Study to December 31, 1972. Considerable progress has been made in the implementation of various Study components and studies are progressing satisfactorily. As the first Progress Report followed closely the Study Agreement of August 24, 1971, this report describes the majority of the Board's activities to date.

THE AGREEMENT:

The Lake Winnipeg, Churchill and Nelson Rivers Study Agreement (Appendix 1) establishes the objective, terms of reference and administrative framework for the conduct of the Study. Funding for the Study is shared equally between Manitoba and Canada and is not to exceed $2,000,000. The Agreement terminates with the submission of a final report no later than December 31, 1974.

OBJECTIVE:

The objective for the Lake Winnipeg, Churchill and Nelson Rivers Study is defined in the Study Agreement as follows:

> "...to determine the effects that regulation of Lake Winnipeg, diversion from the Churchill River and development of hydro-electric potential of the Churchill River diversion route are likely to have on other water and related resource uses and to make recommendations for enhancing the overall benefits with due consideration for the protection of the environment."

TERMS OF REFERENCE:

The Study Agreement outlines the general terms of reference.

> "The study of probable effects of Manitoba Hydro's projects must be sufficiently broad so as to include all important effects on the water regime and on related resource uses and it must be adapted to provide reliable data on present natural conditions and the anticipated and actual conditions arising from the operation of the controls and diversion as designed and constructed. Recommendations will be made consistent with the stated objective of the study. Canada and Manitoba agree to give priority to those studies which may lead to recommendations for modifications or additions to the works, or operation of the works, that may be under construction, approved or proposed. Although there will be no imposed change in regime for at least the next three years, early attention will also be directed to studies which will establish and measure the parameters that define the state of nature conditions for the lakes and rivers involved."

ORGANIZATION & ADMINISTRATION

The Minister of Environment Canada and the Minister of Mines, Resources and Environmental Management of Manitoba have authority for the joint planning and orderly conduct of the Lake Winnipeg, Churchill and Nelson Rivers Study. In accordance with the Study Agreement, a six-member federal/provincial Study Board has been appointed to direct the Study. The Study Board has appointed a Study Director and a Technical Advisory Committee to assist the Board in the planning, implementation and management of the Study. Investigations required by the Study are conducted by federal and provincial agencies, university departments and private consultant firms.

The organizational framework for the planning, implementation, management and general conduct of the Study is shown on page 4.

STUDY BOARD:

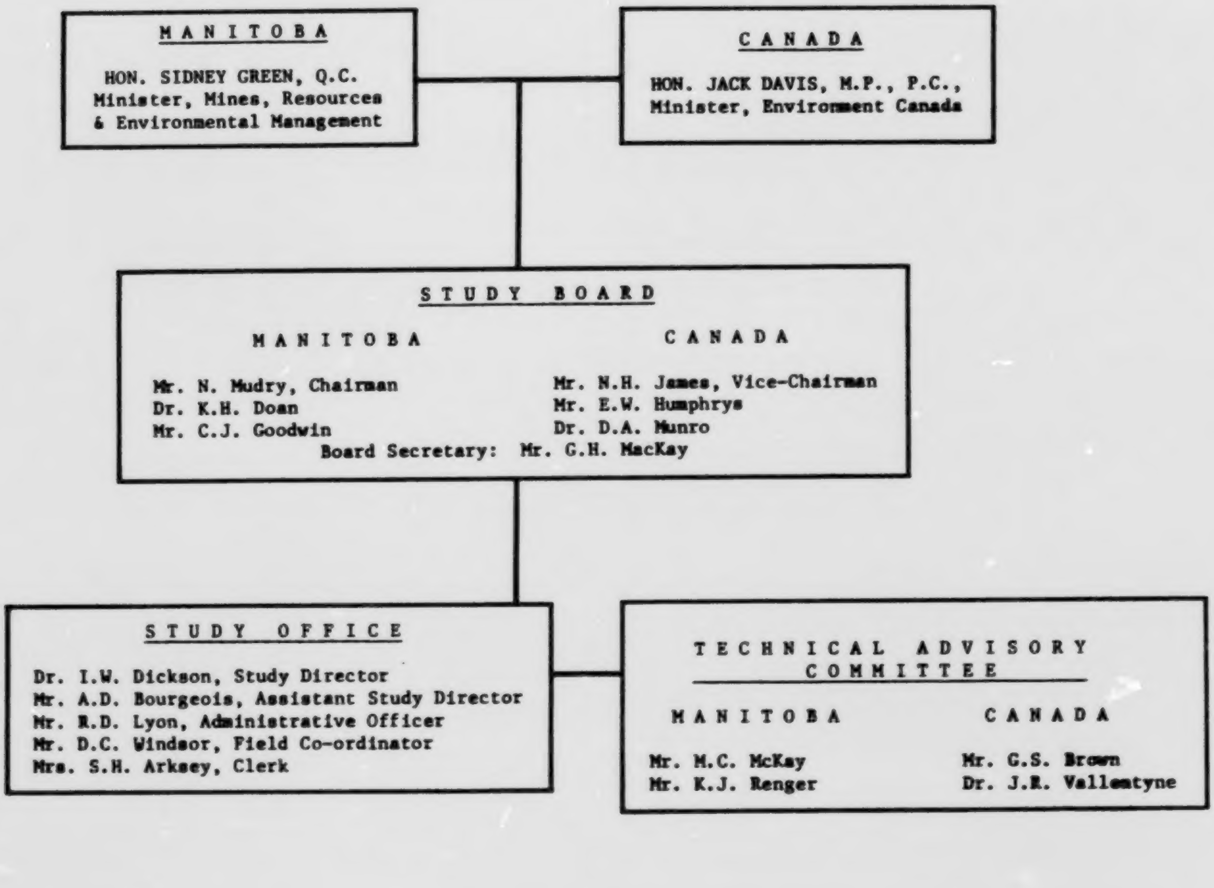
The Board consists of three Canada and three Manitoba members. The Board directs the Study by approving Study plans and schedules, authorizing Study contracts and directing report preparation. To achieve this end the Board has met twelve times and sponsored four workshops.

TECHNICAL ADVISORY COMMITTEE:

A Technical Advisory Committee consisting of two Canada

LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY

ORGANIZATION CHART



MANITOBA

HON. SIDNEY GREEN, Q.C.
Minister, Mines, Resources
& Environmental Management

CANADA

HON. JACK DAVIS, M.P., P.C.,
Minister, Environment Canada

STUDY BOARD

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STUDY OFFICE

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TECHNICAL ADVISORY COMMITTEE

MANITOBA	CANADA
Mr. M.C. McKay	Mr. G.S. Brown
Mr. K.J. Renger	Dr. J.R. Vallentyne

and two Manitoba members has been appointed to advise the Study Director on all matters concerning the development and conduct of the Study program. The Committee reviews Study proposals submitted to the Board and advises the Study Director in respect to the scope and procedures related to program development. The Technical Advisory Committee has held eleven meetings.

BOARD STAFF:

The Board's staff consists of a Study Director, Assistant Study Director, Administrative Officer, Clerk, and Field Coordinator to direct, coordinate, integrate and administer the program.

The Study Board established offices in the Taylor Building, 693 Taylor Avenue, Winnipeg, on February 1, 1972.

The Study Director and his staff have scheduled, organized and coordinated all meetings and workshops conducted on behalf of the Board. Clerical and accounting procedures required by the Study have been developed jointly with the Department of Mines, Resources and Environmental Management. Computer services, drafting and general administrative support are also provided by this Department.

The Field Coordinator has coordinated all field activities by Study contractors, particularly as regards transportation and accommodation. The Board is pleased to report considerable monetary savings as well as increased Study efficiency through the coordinated field program.

CONTRACTS:

Government and other agencies are under contract to conduct the required studies. Private consultant firms have been engaged in the instances where necessary expertise and capability for studies could not be provided by government agencies or local universities. Contractual arrangements respecting Study components, areas for investigation, duration of studies and contract agencies are summarized in Fig. 1.

Study proposals are reviewed by the Board and acceptable programs are approved in principle for funding by the Board. Studies are administered on the basis of annual contracts.

BUDGET:

To date, approximately 95% of the Study funds have been allocated. Funds may be reassigned following annual program review by the Board and/or identification of new studies. A detailed budget statement of Study funds approved, expended and projected is provided in Table 1.

TABLE 1.

LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY

BUDGET STATEMENT OF STUDY FUNDS

STUDY COMPONENT	1971/72	1972/73	1973/74	1974/75	TOTAL APPROVED IN PRINCIPLE	UNCOMMITTED BUT PROJECTED
MAPPING						
-LAKE WINNIPEG, SOUTH BASIN	$ 16,720	$ 22,155	$ -	$ -	$ 38,875	$ -
-RAT/BURNTWOOD	-	112,500	-	-	112,500[1]	-
HYDROLOGIC, HYDRAULIC & GEOMORPHOLOGIC STUDIES						
-IMPACT STUDY	-	75,000	50,000	-	125,000	-
-REAL PROPERTY ASSESSMENT & LAKE WINNIPEG DYKES INVESTIGATION	-	14,200	-	-	14,200	-
-COMMUNITY WATER SUPPLY	-	7,500	-	-	7,500	-
-WATER LEVELS AND FLOWS	-	16,000	-	-	16,000[2]	-
-DREDGE SPOIL, BANK STABILITY	-	25,000	-	-	25,000[3]	-
-SAND MOVEMENT, SHORELINE EROSION	34,225	28,000	32,000	-	94,225	-
NAVIGATION - TRANSPORTATION	-	20,000	-	-	20,000	-
RECREATION						
-LAKE WINNIPEG DEMAND STUDY	13,035	5,465	-	-	18,500	-
-NORTHERN MANITOBA	6,465	30,000	30,000	-	66,465	-
FORESTRY						
-TIMBER FLOODING	-	23,000	-	-	23,000	-
-GROWTH STUDY	-	5,000	-	-	5,000	-
GEOLOGY						
-OSPWAGAN LAKE	-	30,000	-	-	30,000	-
-KISKITTOGISU LAKE	-	30,000	-	-	30,000	-
SOILS, LAND-USE	-	42,000	-	-	42,000	-
FISHERIES - LIMNOLOGY	-	175,000	125,000	-	300,000	-
WILDLIFE	-	51,000	84,000	-	135,000	-
ARCHAEOLOGY	15,000	80,000	-	-	95,000	-
SOCIO-ECONOMIC EVALUATIONS & PROGRAM PLANNING	-	50,000	-	-	50,000	150,000
HYDRO-ELECTRIC ASPECTS	-	-	-	-	-	30,000
TIMBER CLEARING	-	4,000	16,000	-	20,000	-
SUB-TOTAL	85,445	845,820	337,000	-	1,268,265	180,000
ADMINISTRATION						
-STUDY OFFICE	44,665	70,000	80,000	100,000	294,665	-
-CO-ORDINATED FIELD PROGRAM	-	100,000	75,000	-	175,000	-
-CONTINGENCIES	-	-	-	-	-	82,070
TOTAL	$130,110	$1,015,820	$492,000	$100,000	$1,737,930	$262,070

TOTAL OF APPROVED PLUS PROJECTED --- $2,000,000

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[1] Manitoba Hydro commitment of 25% of $150,000 ($37,500) has been deducted.

[2] $16,000 for duration of Study.

[3] An additional $10,000 for possible amelioration study.

MANITOBA HYDRO DEVELOPMENT AND THE STUDY AREA

MANITOBA HYDRO DEVELOPMENT:

Manitoba Hydro's authorized sequence for power development involves, respectively, Lake Winnipeg regulation and Churchill River diversion from Southern Indian Lake to the Nelson River. Lake Winnipeg will be regulated between the levels of 711 and 715 feet by improved outlet capacity and a control structure. Manitoba Hydro is proceeding with Lake Winnipeg regulation.

An interim license to divert water from the Churchill River at Southern Indian Lake to the Nelson River via the Rat and Burntwood rivers has recently been granted to Manitoba Hydro. The license authorizes Manitoba Hydro to divert an average weekly flow of 30,000 c.f.s. However, such diversion must be accomplished so that the flow at Thompson at no time exceeds a flow equivalent to 30,000 c.f.s. plus the long term mean flow of the Burntwood River at Thompson. Another condition of the license requires that Southern Indian Lake be regulated so as to maintain a maximum and minimum elevation of 847 and 844 respectively, with the further provision that during periods when the lake is above elevation 847, maximum discharge out of the lake must be maintained. Construction of the diversion works is to begin during the early part of 1973 with impounding of water scheduled to begin in Southern Indian Lake by 1975 to reach a level of 847 by November 1, 1975.

The Board has identified the following Manitoba Hydro components of particular significance to the Study.

1. Control works at Missi Falls and power generation and control works at Notigi Lake.
2. Burntwood River power developments planned for Wuskwatim, Manasan and First Rapids.
3. Control works and hydro-electric power generating facilities in the Outlet Lakes area (Jenpeg).

The above sites are identified in Fig. 2.

STUDY AREA:

The total Study area encompasses Lake Winnipeg and major portions of the Churchill and Nelson rivers. The Board has specified five (5) geographical areas for studies on the basis of (a) the location of Manitoba Hydro's proposed developments and (b) environmental impacts associated with these developments (Fig. 2).

Area I - Lake Winnipeg

The outlet capacity of Lake Winnipeg will be increased and a control structure will be installed at Jenpeg on the West Channel of the Nelson River to regulate the lake. This change in outlet configuration and pattern of outflow will alter the pattern of Lake Winnipeg levels from those that would occur without regulation.

Area II - Outlet Lakes

The pattern of levels and flows will be altered in the lakes and the Nelson River channels above and below the Jenpeg control structure. Specific waters of concern in the Outlet Lakes area include the East and West Channels of the Nelson River, Kiskitto Lake, Kiskittogisu Lake, Playgreen Lake, Pipestone Lake and Cross Lake. In accordance with the Study Agreement, studies associated with the control works currently being constructed in the Outlet Lakes area have been given priority. Locations of Manitoba Hydro's control works in the Outlet Lakes area are shown in Fig. 3.

Area III - Diversion Route

Diversion of the Churchill River will introduce additional water to the Rat and Burntwood rivers. This will greatly increase flows in these streams and alter the water levels in the stream channels. The pattern of flows, water level fluctuations and water quality will also be significantly changed in these rivers. In addition, proposed hydro-electric power projects along the diversion route will flood land and form new shorelines in headpond areas (Fig. 4).

Area IV - Southern Indian Lake

Lake levels at Southern Indian Lake will increase to a maximum of 850 elevation following completion of the Missi Falls and Notigi control works. Raised water levels will increase the area of Southern Indian Lake by 13% to about 790,000 acres.

Area V - Lower Churchill River

Diversion of 30,000 c.f.s. out of Southern Indian Lake will significantly alter the quantity and pattern of flow in the Churchill River downstream from Missi Falls, and, consequently, the pattern of water level fluctuation.

STUDIES

Studies required to carry out the Board's terms of reference have been contracted to various government agencies, universities and private consultants. Studies contracted during 1972 are in various stages of completion.

The Board's initiative has led to a joint federal/provincial water quality monitoring program specific to the Study area. Similarly, the Board has requested a study proposal to design a long-term ecological monitoring program to assess the effects attributed to the Manitoba Hydro scheme.

The Board has encountered minor problems in some areas. Wildlife studies were delayed while the Board sought the necessary federal/provincial expertise to conduct the required wildlife investigations. Likewise, the Board encountered considerable difficulty in obtaining particular expertise required for studies of resource economics and social impact considerations. These problem areas have been resolved and satisfactory progress can be reported for all areas.

Particulars concerning progress of the various Study components have been summarized in tabular form as follows.

SUMMARY OF STUDY COMPONENTS

STUDY COMPONENT	CONTRACT AGENCY	OBJECTIVE	INVESTIGATION AREA	COMPLETION DATE
MAPPING	Surveys, Mapping & Lands Branch, Manitoba Department of Mines, Resources & Environmental Management	To provide contour maps for definition of particular sections of the Study area including land to be flooded.	Lake Winnipeg Shoreline (South Basin) Churchill-Burntwood Diversion Route	May 30, 1972. March 31, 1973.
HYDROLOGIC, HYDRAULIC & GEOMORPHOLOGIC STUDIES **(a) Impact Study**	Department of Civil Engineering, The University of Manitoba	To define anticipated physical changes to river & lake characteristics resulting from Churchill River diversion & Lake Winnipeg regulation	Churchill & Nelson River Systems and Selected Reservoirs	March 31, 1973.
(b) Dredge-Spoil and Bank Stability Study	Water Resources Branch, Manitoba Department of Mines, Resources and Environmental Management	To assess site specific effects on physical environment of construction of control works required for Lake Winnipeg regulation & of diversion of the Churchill River.	2-Mile Channel Area 8-Mile Channel Area Burntwood River at Thompson Other sites to be identified pending results of Impact Study	}August, 1972. }February, 1973.
(c) Lake Winnipeg Shoreline Erosion and Sand Movement Study	Water Resources Branch, Manitoba Department of Mines, Resources and Environmental Management	To determine effect of Lake Winnipeg regulation on sand movement & shoreline erosion around the south part of Lake Winnipeg.	Lake Winnipeg (South Basin)	March 31, 1974.

STUDY COMPONENT	CONTRACT AGENCY	OBJECTIVE	INVESTIGATION AREA	COMPLETION DATE
(d) Real Property Assessment & Lake Winnipeg Dykes Investigation	Water Resources Branch, Manitoba Department of Mines, Resources and Environmental Management	To assess anticipated effects of increased water levels within the project area on real property & to determine the effect of Lake Winnipeg regulation on a temporary dyking system around portions of the South basin of Lake Winnipeg.	Northern townsites & communities. Lake Winnipeg (dyking system)	March 31, 1973.
(e) Community Water Supply	Water Resources Branch, Manitoba Department of Mines, Resources and Environmental Management	To determine effect of Churchill River diversion & Lake Winnipeg regulation on quantity & quality of water required for domestic and industrial uses.	Northern townsites & communities. Lake Winnipeg settlements.	March 31, 1973.
(f) Water Levels & Flows, Data Interpretation	Water Resources Branch, Manitoba Department of Mines, Resources and Environmental Management	To provide engineering and drafting services to the Study Office as required.	--	Duration of the Study.
NAVIGATION-TRANSPORTATION	Faculty of Administrative Studies, University of Manitoba	To determine implications to navigation & transportation resulting from the proposed hydro power development.	Outlet Lakes Lake Winnipeg Southern Indian Lake Diversion Route	March 31, 1973.
RECREATION	Parks Branch, Manitoba Department of Tourism, Recreation & Cultural Affairs.	To determine effect of Hydro's power development on recreation potential of the Study area.	Lake Winnipeg Diversion Route Churchill River Southern Indian Lake Outlet Lakes	July, 1972 March 31, 1974.

STUDY COMPONENT	CONTRACT AGENCY	OBJECTIVE	INVESTIGATION AREA	COMPLETION DATE
FORESTRY (a) Timber Inventory (b) Growth Study	Research Branch, Manitoba Department of Mines, Resources and Environmental Management	(a) To determine quality, quantity & value of timber to be inundated. (b) To assess the impact of flooding on growth of timber situated in close proximity to newly established shorelines.	(a) Outlet Lakes Southern Indian Lake Diversion Route (b) Cedar Lake Sipiwesk Lake	April, 1972. March 31, 1973.
GEOLOGY	Mines Branch, Manitoba Department of Mines, Resources and Environmental Management	To provide opportunity for early geological explo[illegible] in areas anticipated t[illegible] flooded as a result o[illegible] proposed power program	Kiskittogisu Lake Area Ospwagan Lake Area	March 31, 1973.
SOILS, LAND-USE	University of Manitoba, Manitoba Soil Survey	To provide land classification & planimetric data pertinent to a description of soils,land forms & vegetation in major environmental impact areas.	Outlet Lakes Area Diversion Route Southern Indian Lake	May, 1973.
FISHERIES-LIMNOLOGY	Freshwater Institute, Environment Canada	To determine effect of Hydro's program on fisheries in the Study area.	Southern Indian Lake Churchill River Diversion Route	March 31, 1974.
ILDLIFE	F. F. Slaney & Company Limited	To determine effect of Hydro's program on wildlife habitat & populations within the Study area.	Outlet Lakes Lake Winnipeg Diversion Route Southern Indian Lake Churchill River	March 31, 1973. March 31, 1974.

STUDY COMPONENT	CONTRACT AGENCY	OBJECTIVE	INVESTIGATION AREA	COMPLETION DATE
ARCHAEOLOGY	University of Winnipeg, Churchill Diversion Archaeological Project	Identify archaeological sites in that portion of the Study area where flooding is anticipated.	Rat/Burntwood River Kiskittogisu Lake	March 31, 1973.
SOCIO-ECONOMIC EVALUATIONS AND PROGRAM PLANNING	Acres Consulting Services Limited and Harry Hill Consulting Limited	To provide expertise competent in areas of social impact considerations, resource economic evaluations, & program planning & systems development.	Office Studies	Duration of Study.
WATER QUALITY (a) Biological Productivity (b) Monitoring Program	 Freshwater Institute Manitoba Environmental Protection Branch	To provide water quality data required for (1) assessment of biological productivity, (2) for identification of implications to community water supplies required for domestic consumption, and (3) to provide a water quality data base to assess changes in water quality attributed to Churchill River diversion & Lake Winnipeg regulation.	(a) Southern Indian Lake Diversion Route Churchill River (b) Selected sites throughout the Study area	Continuing federal provincial monitoring program.
ECOLOGICAL MONITORING PROGRAM	To be identified	To determine the long-term effects on the ecology of an environment situated adjacent to major river-lake systems characterized by significant alterations in water levels and flows.	Selected sites throughout the Study area	Research proposal currently being developed by federal, provincial and university staff.

HIGHLIGHTS OF PROGRESS IN 1972

Although the majority of studies contracted by the Board are in various stages of completion, preliminary observations to date have enabled the Board to identify specific areas of concern and to report significant findings by certain study sectors. These "highlights" of progress are summarized and reported briefly as follows:

1. DREDGE-SPOIL AND RIVER BANK STABILITY STUDIES

Two site specific studies were initiated by the Board early in 1972 to (a) describe for resource disciplines those physical changes to the environment attributed to Manitoba Hydro's dredging operation in the Eight-mile Channel area, and (b) to describe implications to bank stability of the Burntwood River at Thompson as a result of altered levels and flows attributed to the proposed diversion of the Churchill River.

Studies of dredge-spoil deposition in the Eight-mile Channel area indicated a potential distribution of dredge-spoil over a significant area (Manitoba Hydro's contract governing dredging operations in the Eight-mile Channel provides for a dredge-spoil deposition area of approximately 50 square miles). In addition to identifying environmental change, these studies revealed the potential for altered water quality and silt loading of aquatic systems in close proximity to the dredge-spoil area. Wildlife and fisheries disciplines have given particular attention to the impact of dredging operations on these resources.

Specifications governing the dredging operations have been described as inadequate for the purpose of protecting resources in the area and minimizing environmental degradation. The Board has identified this specific site in the Study area as an issue of particular concern.

River bank stability studies for the Burntwood River at Thompson based on data describing anticipated water levels and flows associated with Churchill River diversion have revealed implications to Thompson townsite facilities. Increased levels of the Burntwood River during high water periods could result in local flooding of Thompson townsite properties such as local water and air transport mooring facilities, sewer and water supply systems and undeveloped sections of the Thompson cemetery. Further, the planned Manasan Dam development by Manitoba Hydro will flood sections of the Burntwood River in close proximity to the Thompson - Lynn Lake Highway. Flooding in these areas may necessitate rerouting, raising and/or dyking particular stretches of this highway. The Board has recommended that these specific aspects associated with the Manitoba Hydro development receive further consideration by Manitoba Hydro.

2. REAL PROPERTY ASSESSMENT STUDY

An inventory of real property which would be affected by raised water levels due to the Manitoba Hydro projects is nearing completion. It was learned during the conduct of these studies on Southern Indian Lake, that a fish station renovation program has been undertaken by South Indian Lake Fisheries Co-operative Limited. Some of the affected fish stations are located in areas to be flooded. The Board wishes to emphasize the urgency for proper communication between the appropriate agencies and Manitoba Hydro to avoid the possibility of renovated or new fish stations being subject to future flood damages. In addition to flood concerns, similar consideration should be given to suitable access and navigation routes for fish station sites as these may be impeded by developments associated with the proposed Hydro works (floating logs, standing flooded timber, etc.).

3. RECREATION

Recreation studies currently in progress have identified both macro and micro sites for recreational development. Recreation investigations have given priority to inventory activities in the areas of Southern Indian Lake and Rat-Burntwood rivers. In addition, as requested by the Board, this study sector has examined the recreational potential of areas to be affected by current construction activities in the

Outlet Lakes area (Jenpeg power site, Eight-mile Channel, etc.). Potential recreation areas have been generally identified to date. These are as follows:

(a) South end of Notigi Lake; Rat River; Wapisu Lake; Manasan Falls to Thompson (Burntwood River); Thompson townsite to First Rapids; Leaf Rapids to South Bay.

(b) Lower West Channel of the Nelson River; South end of Cross Lake; East Channel of the Nelson River (Sugar Falls).

More particularly, the recreation sector has identified specific recreation site developments and recommended specific guidelines for construction activities in these areas.

(a) The area adjacent to the Rat River in the vicinity of the Notigi Lake control structure and Highway #391 has recreational potential. Construction should proceed in a manner which will preserve the area below the Notigi Dam to the north of Wapisu Lake for recreation.

(b) The vicinity of the Minago River crossing of the Jenpeg road should be protected from intrusions for gravel and borrow pits.

(c) Decisions regarding Manitoba Hydro's plans for the East Channel of the Nelson River should reflect concern for preservation of the recreational potential of this area.

The Board stresses the importance of these potential recreation sites in Manitoba Hydro plans for power development.

A report titled "Lake Winnipeg Recreational Demand Study" prepared for the Board by the Manitoba Department of Tourism, Recreation and Cultural Affairs, Research and Planning Branch, was completed in June, 1972. This report describes the expected demand patterns of tourism and recreational use of the Study area. These results when integrated with results of a current study of the influence of Lake Winnipeg regulation upon Lake Winnipeg beaches and shoreline, will provide an estimate of the impact that regulation will have on recreational aspects associated with Lake Winnipeg.

4. FISHERIES-LIMNOLOGY AND WILDLIFE

Fisheries and wildlife study sectors have expressed considerable concern for the Eight-mile dredging operations as these construction activities may have a significant impact on fisheries and wildlife in the area and cause general environmental disruption. Their views when coupled with information provided from dredge-spoil studies causes the Board considerable concern. The Board has identified this matter as an important issue in earlier sections of this report.

Manitoba Hydro has provided detailed plans for regulation of lake levels on Kiskitto Lake. Briefly described, plans for Kiskitto Lake regulation identify (a) inlet control works to permit inflows from the West Channel of the Nelson River to Kiskitto Lake and (b) outlet control works to provide outflows from Kiskitto Lake to the Minago River. Fisheries and wildlife sectors have conflicting views regarding the desired water levels for Kiskitto Lake. Water quality as it may be affected by regulation is their primary concern. Further, fisheries and wildlife resources may be enhanced by the rate at which water levels may be fluctuated by the control works. The Board emphasises, therefore, the importance of involving fisheries and wildlife in the design of control works as these may be used to enhance overall benefits to resources in the area.

Fisheries studies conducted during 1972, indicate that the Churchill River is the major nutrient source for Southern Indian Lake and that this river contributes significantly to the productivity of Southern Indian Lake. Reduced flow through the northern portion of the lake is expected to be of major significance to interpretation of effects of diversion to the Southern Indian Lake fishery and fisheries.

5. MAPPING

Mapping required by the Study within the time constraints specified by the Board posed serious problems with respect to obtaining necessary horizontal and vertical control using conventional methods. Discussions with survey personnel in government and industry revealed a relatively new airborne control survey technique suited to this purpose. This technique is known as the A.B.C. System and consists of measuring tellurometer distances and horizontal and vertical angles from ground stations to an airborne helicopter platform. This system achieved the necessary control to specified accuracies enabling mapping to proceed as scheduled.

6. WATER QUALITY

A joint water quality program involving a number of federal and provincial agencies, Manitoba Hydro and Study contractors has been developed to assimilate and integrate results of water quality monitoring programs. Such water quality data will make a significant contribution to the Lake Winnipeg, Churchill and Nelson Rivers Study in the short term and provide a basis for a future and continuing federal and provincial water quality monitoring program in the longer term.

7. SOILS, LAND-USE

Land classification maps specific to the Study area are currently being developed for interpretation of changes in the land-water interface attributed to the proposed Manitoba Hydro project. Soil data on permafrost distribution and condition are particularly pertinent to project impact.

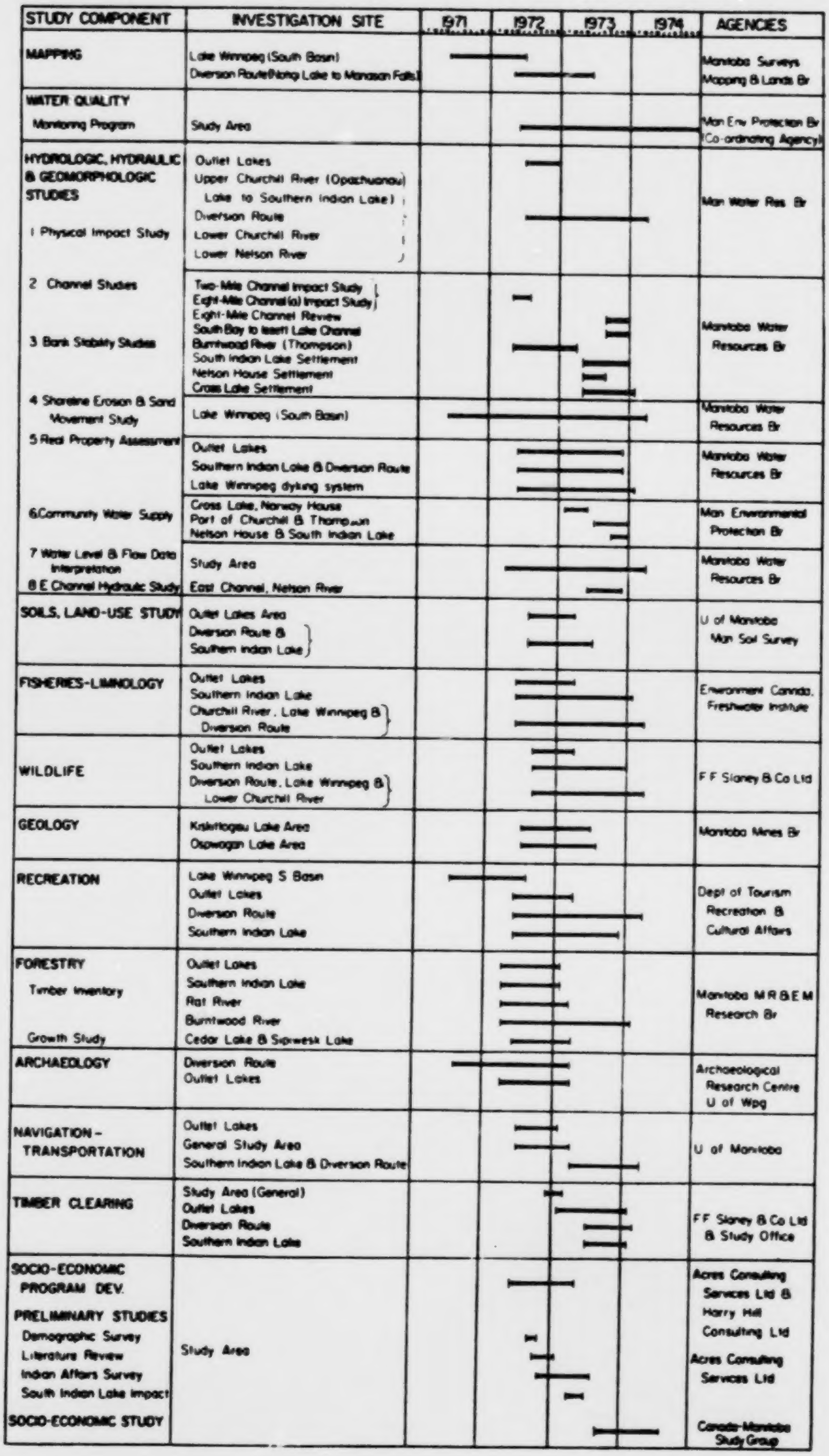
8. ARCHAEOLOGY

Study Board funding of archaeological investigations in the Study area has provided an opportunity for archaeological discoveries of considerable significance to Manitoba's historical and archaeological records. Information obtained to date suggests new evidence of historical events formerly unrecorded and unknown in Manitoba. New techniques have been developed to allow for the rapid survey of large geographical areas during the short time periods to produce statistically reliable data interpretation.

FIGURE 1.

LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY

STUDY COMPONENTS, AREAS OF INVESTIGATION, STUDY PERIODS, CONTRACT AGENCIES



STUDY COMPONENT	INVESTIGATION SITE	1971	1972	1973	1974	AGENCIES
MAPPING	Lake Winnipeg (South Basin)					Manitoba Surveys Mapping & Lands Br
	Diversion Route (Notigi Lake to Manasan Falls)					
WATER QUALITY Monitoring Program	Study Area					Man Env Protection Br (Co-ordinating Agency)
HYDROLOGIC, HYDRAULIC & GEOMORPHOLOGIC STUDIES 1 Physical Impact Study	Outlet Lakes					Man Water Res. Br
	Upper Churchill River (Opachuanau Lake to Southern Indian Lake)					
	Diversion Route					
	Lower Churchill River					
	Lower Nelson River					
2 Channel Studies	Two-Mile Channel Impact Study					Manitoba Water Resources Br
	Eight-Mile Channel(s) Impact Study					
	Eight-Mile Channel Review					
3 Bank Stability Studies	South Bay to Issett Lake Channel					
	Burntwood River (Thompson)					
	South Indian Lake Settlement					
	Nelson House Settlement					
	Cross Lake Settlement					
4 Shoreline Erosion & Sand Movement Study	Lake Winnipeg (South Basin)					Manitoba Water Resources Br
5 Real Property Assessment	Outlet Lakes					Manitoba Water Resources Br
	Southern Indian Lake & Diversion Route					
	Lake Winnipeg dyking system					
6 Community Water Supply	Cross Lake, Norway House					Man Environmental Protection Br
	Port of Churchill & Thompson					
	Nelson House & South Indian Lake					
7 Water Level & Flow Data Interpretation	Study Area					Manitoba Water Resources Br
8 E Channel Hydraulic Study	East Channel, Nelson River					
SOILS, LAND-USE STUDY	Outlet Lakes Area					U of Manitoba Man Soil Survey
	Diversion Route & Southern Indian Lake					
FISHERIES-LIMNOLOGY	Outlet Lakes					Environment Canada, Freshwater Institute
	Southern Indian Lake					
	Churchill River, Lake Winnipeg & Diversion Route					
WILDLIFE	Outlet Lakes					F F Slaney & Co Ltd
	Southern Indian Lake					
	Diversion Route, Lake Winnipeg & Lower Churchill River					
GEOLOGY	Kiskittogisu Lake Area					Manitoba Mines Br
	Ospwagan Lake Area					
RECREATION	Lake Winnipeg S Basin					Dept of Tourism Recreation & Cultural Affairs
	Outlet Lakes					
	Diversion Route					
	Southern Indian Lake					
FORESTRY Timber Inventory	Outlet Lakes					Manitoba M R & E M Research Br
	Southern Indian Lake					
	Rat River					
	Burntwood River					
Growth Study	Cedar Lake & Sipiwesk Lake					
ARCHAEOLOGY	Diversion Route					Archaeological Research Centre U of Wpg
	Outlet Lakes					
NAVIGATION - TRANSPORTATION	Outlet Lakes					U of Manitoba
	General Study Area					
	Southern Indian Lake & Diversion Route					
TIMBER CLEARING	Study Area (General)					FF Slaney & Co Ltd & Study Office
	Outlet Lakes					
	Diversion Route					
	Southern Indian Lake					
SOCIO-ECONOMIC PROGRAM DEV.	Study Area					Acres Consulting Services Ltd & Harry Hill Consulting Ltd
PRELIMINARY STUDIES Demographic Survey						Acres Consulting Services Ltd
Literature Review						
Indian Affairs Survey						
South Indian Lake Impact						
SOCIO-ECONOMIC STUDY						Canada-Manitoba Study Group

Figure 2

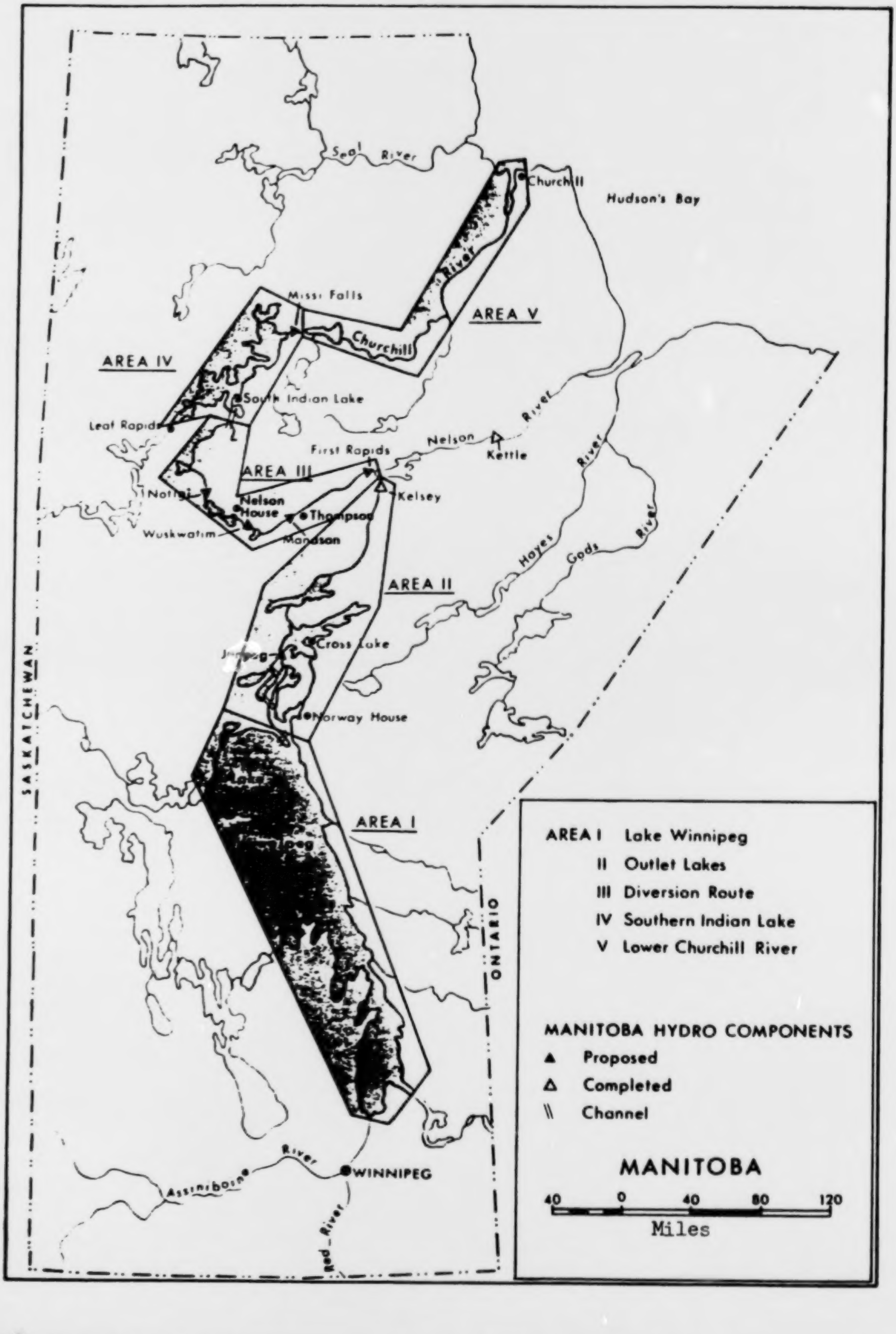
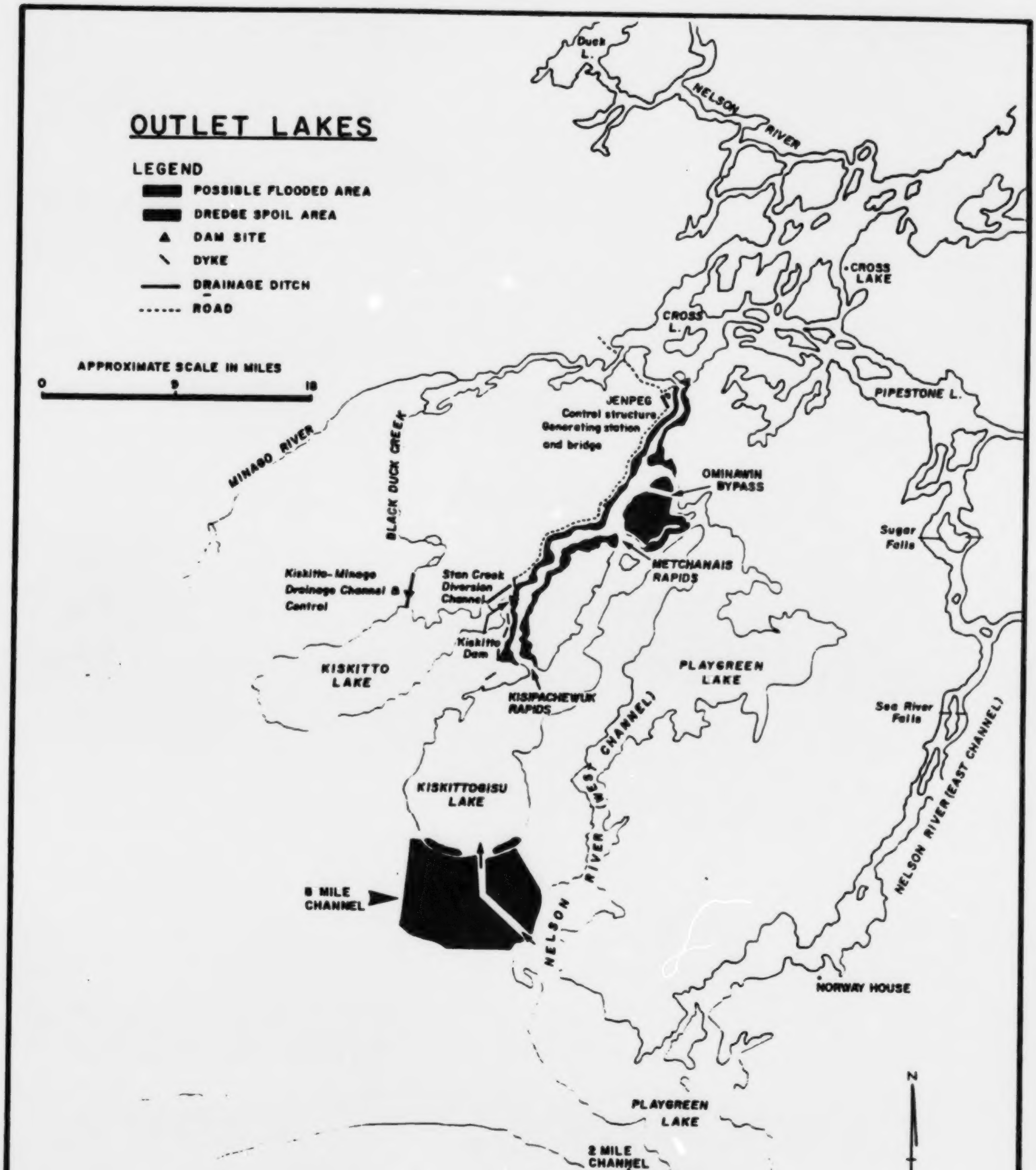

Seal River
Churchill
Hudson's Bay
Churchill River
Missi Falls
AREA V
AREA IV
South Indian Lake
Leaf Rapids
Nelson River
Kettle
First Rapids
AREA III
Kelsey
Notigi
Nelson House
Thompson
Wuskwatim
Manasan
Hayes River
Gods River
AREA II
Cross Lake
Norway House
AREA I
SASKATCHEWAN
ONTARIO
Assiniboine River
WINNIPEG
Red River
AREA I Lake Winnipeg
II Outlet Lakes
III Diversion Route
IV Southern Indian Lake
V Lower Churchill River
MANITOBA HYDRO COMPONENTS
▲ Proposed
△ Completed
\\ Channel
MANITOBA
40
0
40
80
120
Miles

FIGURE 3.


OUTLET LAKES
LEGEND
POSSIBLE FLOODED AREA
DREDGE SPOIL AREA
DAM SITE
DYKE
DRAINAGE DITCH
ROAD
APPROXIMATE SCALE IN MILES
0
9
18
Duck L.
NELSON RIVER
CROSS LAKE
CROSS L.
PIPESTONE L.
JENPEG
Control structure, Generating station and bridge
OMINAWIN BYPASS
METCHANAIS RAPIDS
MINAGO RIVER
BLACK DUCK CREEK
Kiskitto-Minago Drainage Channel & Control
Stan Creek Diversion Channel
Kiskitto Dam
KISKITTO LAKE
KISIPACHEWUK RAPIDS
PLAYGREEN LAKE
Sugar Falls
Sea River Falls
NELSON RIVER (WEST CHANNEL)
NELSON RIVER (EAST CHANNEL)
KISKITTOGISU LAKE
8 MILE CHANNEL
NORWAY HOUSE
N
PLAYGREEN LAKE
2 MILE CHANNEL
LAKE WINNIPEG
WARREN LANDING

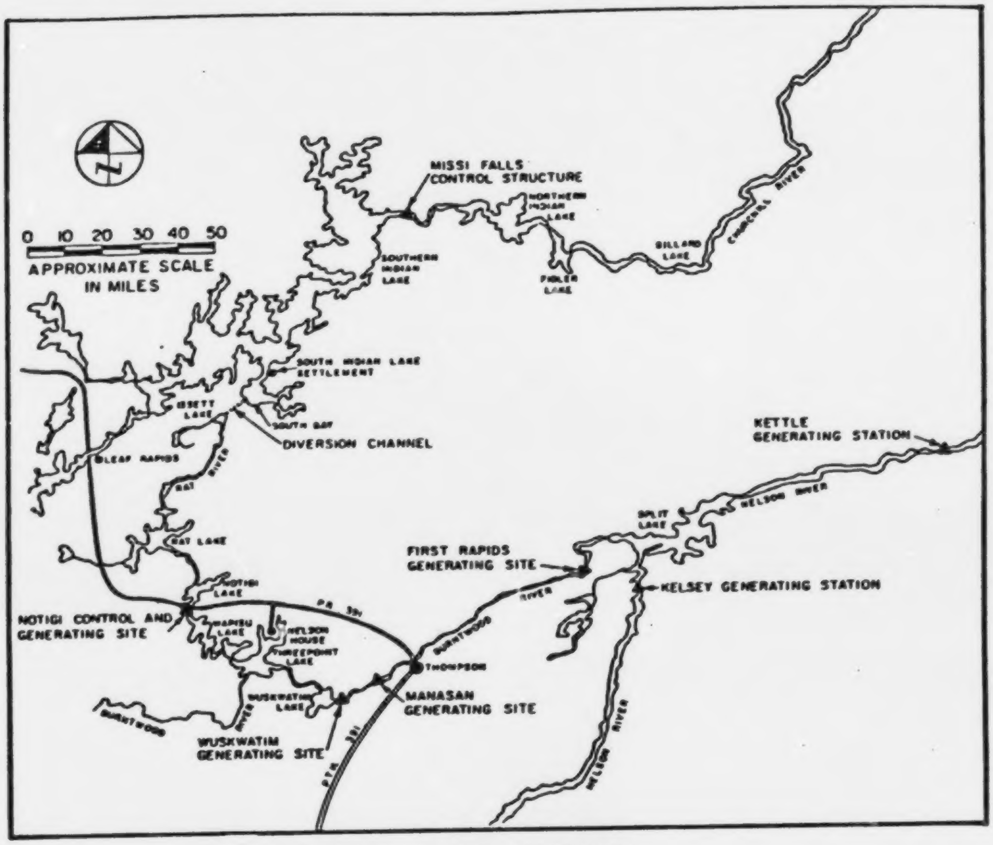


FIG. 4 CHURCHILL RIVER DIVERSION.

APPENDIX 1 - L

PROGRESS REPORT
NUMBER 3
DECEMBER 31, 1973

PROGRESS REPORT
NUMBER 3
DECEMBER 31, 1973

by

The Lake Winnipeg, Churchill and Nelson Rivers Study Board
Winnipeg, Manitoba
December, 1973

RECOMMENDATIONS

1. The Board suggests that any mitigation works or enhancement measures associated with channel construction in the Outlet Lakes area need not be undertaken until after construction is completed and Lake Winnipeg is regulated.

2. The Board recommends that appropriate agencies be requested to initiate or expand programs to detect changes in water quality and sediment loading in those site-specific areas to be particularly influenced by construction and operation of Manitoba Hydro's works (e.g. Eight-mile Channel, Two-mile Channel, South Bay to Issett Lake Channel).

3. The Board recommends that Manitoba Hydro review its sediment monitoring program associated with construction and operation of the Eight-mile Channel having due regard for the effect of sediment deposition on fish. The Board further recommends that monitoring of sediment loading associated with construction and operation of the Two-mile and Issett Lake to South Bay channels be implemented, after consultation with appropriate agencies having regard to the purpose of the said monitoring.

4. To preserve or protect areas of recreational potential and generally to maintain environmental quality, the Board

recommends that

(a) no intrusions for construction material occur within one mile of the Minago River crossing for the Wabowden to Jenpeg road,

(b) hunting and fishing activities of construction workers be controlled to preserve fish and wildlife that may be important food sources for local residents,

(c) for all stream crossings where bridges or other types of crossings are deployed, the access be selectively cleared and the fill required for the crossings prevented from entering the stream, and

(d) a treed buffer zone be maintained around borrow pits and between roads and power transmission lines to minimize the unsightly appearance of these construction sites.

5. The Board recommends that Manitoba Hydro promptly complete its program of advising holders of land entitlements, mining claims, timber permits, etc. as to its hydroelectric developments, and make the effects of these developments known to the residents within the area of influence.

6. The Board recommends that appropriate Provincial agencies conduct intensive studies to determine the socio-economic feasibility of a timber salvage program in areas where good quality and adequate timber is located in close proximity

to a potential labor force and readily available transportation facilities.

7. The Board recommends that Manitoba Hydro protect or relocate real property to be affected by the diversion of the Churchill River, including water pumphouses, sewers, docks, houses, roads and cemeteries at South Indian Lake, Nelson House and Thompson, and fish camps around Southern Indian Lake and along the diversion route.

8. The Board recommends that Manitoba Hydro take whatever action is necessary to protect the Town of Churchill's water supply facilities from salt water intrusion and from ice damage.

9. The Board recommends that Manitoba Hydro prepare a graphical information brochure to illustrate the nature, scope, and anticipated physical changes associated with its Nelson River development program.

CONCERNS

The Board has been alerted to concerns which because of the nature of their implications, other Study priorities and constraints of time and funds afforded by the Study Agreement may not be properly attended to by the Study. Nevertheless, these concerns are deserving of attention in order to comply with the objective and terms of reference of the Study Agreement.

1. Manitoba Hydro Development Plans and Specifications.

   Design plans and specifications provided by Manitoba Hydro have been used at the outset and during the course of the Study to determine the areas of impact and Study requirements. It follows that any major modification to the description of Manitoba Hydro's project (particularly information regarding water levels, flows and associated ice regimes) may alter the interpretation of anticipated impacts and significantly change the nature and scope of required studies. Timing and funding constraints of the Board's program limit its capability to initiate new investigations or update and revise completed and ongoing studies as new information is provided by Manitoba Hydro. Additional studies may, therefore, be required that are beyond the timing and funding identified by the Study Agreement.

2. Ice Regime Changes.

The impact of Lake Winnipeg regulation and the Churchill River diversion on the ice regime and associated water levels and flows is significant in determining the extent and importance of damages to real property and related socio-economic effects to residents of South Indian Lake, Nelson House, Cross Lake and the Town of Churchill. Little information is currently available to predict accurately the impact on the ice regime. The Board has initiated limited studies to study possible ice regime changes, however, it has been advised that more complex and more comprehensive studies are required to assess changes in the ice regime properly.

3. Cross Lake Water Level Fluctuations

Other priorities and costs associated with a comprehensive hydrographic survey of Cross Lake have prevented the Board from obtaining accurate and precise data on lake depths and shoreline configuration. Such data when correlated with information on regulated lake level and flow conditions are necessary to describe the new Cross Lake shoreline and depths attributed to Lake Winnipeg regulation. The lack of information by which to describe these new lake characteristics delimits the Board's ability to measure the effects of Manitoba Hydro's works on local life styles of residents of Cross Lake (e.g. effects on winter and summer travel on the lake as required by fishing and trapping activities and for local transportation).

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INTRODUCTION

Studies required for the preparation of a final report on the Lake Winnipeg, Churchill and Nelson Rivers Study are nearing completion. Comprehensive field surveys and inventories associated primarily with geomorphologic, fisheries and wildlife studies are in their final stages.

Areas of immediate concern to the Board have been identified in progress and other interim reports to Manitoba Hydro and the respective governments. Delays associated with physical impact and socio-economic studies have altered Study scheduling and reporting but are not expected to significantly impede the preparation and submission of a final report.

This report constitutes a review and summary of the Board's activities and progress in the conduct of the Lake Winnipeg, Churchill and Nelson Rivers Study to December 31, 1973.

THE AGREEMENT

The Lake Winnipeg, Churchill and Nelson Rivers Study Agreement (Appendix I) establishes the objective, terms of reference and administrative framework for the conduct of the Study. Funding for the Study is shared equally between Manitoba and Canada and is not to exceed $2,000,000. The Agreement terminates with the submission of a final report no later than December 31, 1974.

OBJECTIVE

The objective for the Lake Winnipeg, Churchill and Nelson Rivers Study is defined in the Study Agreement as follows:

> "... to determine the effects that regulation of Lake Winnipeg, diversion from the Churchill River and development of hydro-electric potential of the Churchill River diversion route are likely to have on other water and related resource uses and to make recommendations for enhancing the overall benefits with due consideration for the protection of the environment."

TERMS OF REFERENCE

The Study Agreement outlines the general terms of reference.

> "The Study of probable effects of Manitoba Hydro's projects must be sufficiently broad so as to include all important effects on the water regime and on related resource uses and it must be adapted to provide reliable data on present natural conditions and the anticipated and actual conditions arising from the operation of the controls and diversion as designed and constructed. Recommendations will be made consistent with the stated objective of the study. Canada and Manitoba agree to give priority to those studies which may lead to recommendations for modifications or additions to the works, or operation of the works, that may be under construction, approved or proposed. Although there will be no imposed change in regime for at least the next three years, early attention will also be directed to studies which will establish and measure the parameters that define the state of nature conditions for the lakes and rivers involved."

ORGANIZATION AND ADMINISTRATION

The Minister of Environment Canada and the Minister of Mines, Resources and Environmental Management of Manitoba have authority for the joint planning and orderly conduct of the Lake Winnipeg, Churchill and Nelson Rivers Study. In accordance with the Study Agreement, a six-member Federal/Provincial Study Board has been appointed to direct the Study. The Study Board has appointed a Study Director and a Technical Advisory Committee to assist in the planning, implementation and management of the Study. Investigations required by the Board are conducted by federal and provincial agencies, university departments and private consultant firms.

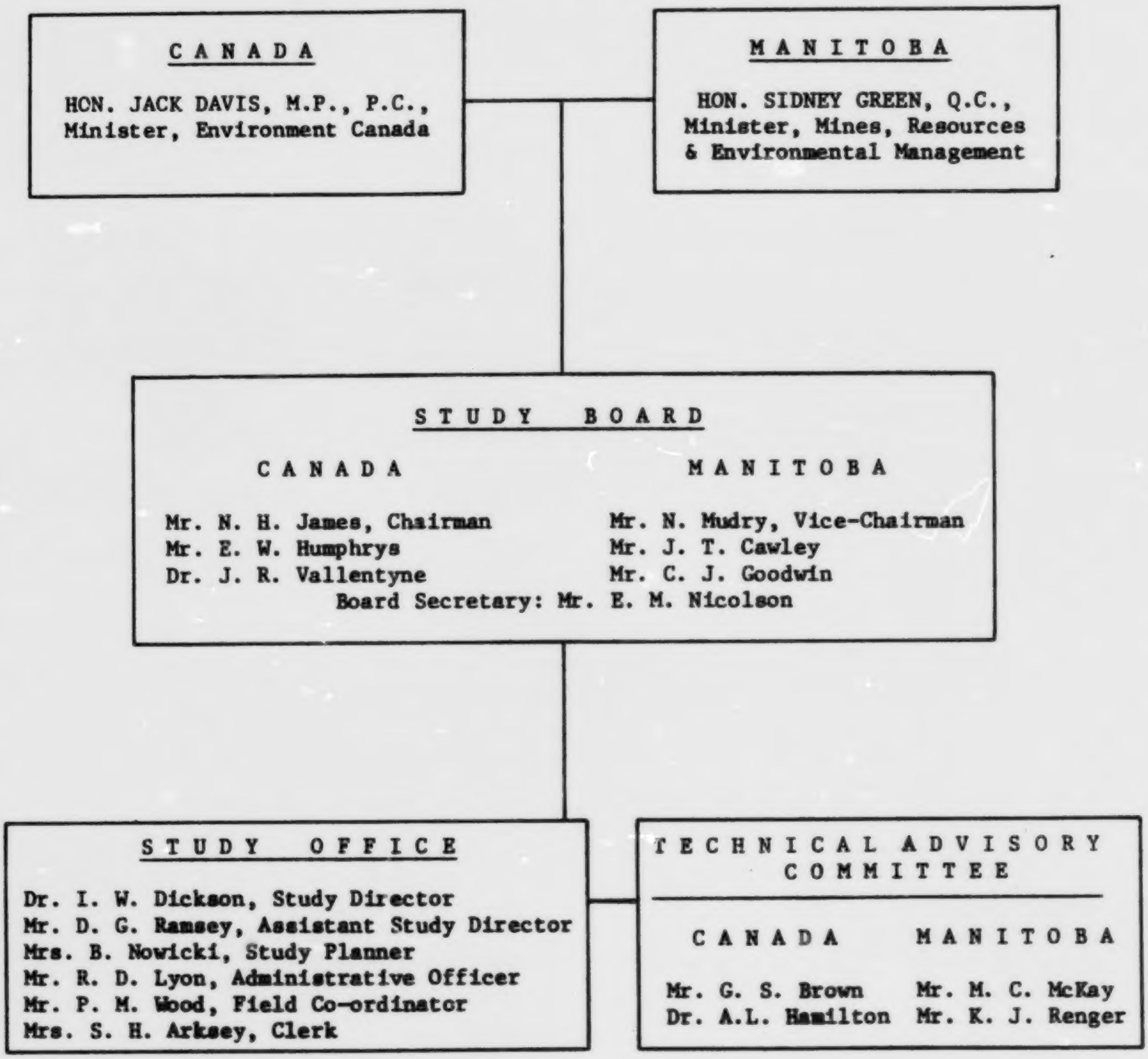
The organizational framework for the planning, implementation, management and general conduct of the Study is shown on page 4.

STUDY BOARD

The Board, consisting of three Canada and three Manitoba members, directs the Study by approving plans and schedules, authorizing Study contracts and directing report preparation. The Board has met 20 times and has sponsored five workshops. Board membership changed in April, 1973, when Dr. J. R. Vallentyne replaced Dr. D. A. Munro, Canada, and Mr. J. T. Cawley replaced Dr. K. H. Doan, Manitoba.

LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY

ORGANIZATION CHART



CANADA

HON. JACK DAVIS, M.P., P.C.,
Minister, Environment Canada

MANITOBA

HON. SIDNEY GREEN, Q.C.,
Minister, Mines, Resources
& Environmental Management

STUDY BOARD

CANADA	MANITOBA
Mr. N. H. James, Chairman	Mr. N. Mudry, Vice-Chairman
Mr. E. W. Humphrys	Mr. J. T. Cawley
Dr. J. R. Vallentyne	Mr. C. J. Goodwin

Board Secretary: Mr. E. M. Nicolson

STUDY OFFICE

Dr. I. W. Dickson, Study Director
Mr. D. G. Ramsey, Assistant Study Director
Mrs. B. Nowicki, Study Planner
Mr. R. D. Lyon, Administrative Officer
Mr. P. M. Wood, Field Co-ordinator
Mrs. S. H. Arksey, Clerk

TECHNICAL ADVISORY COMMITTEE

CANADA	MANITOBA
Mr. G. S. Brown	Mr. M. C. McKay
Dr. A.L. Hamilton	Mr. K. J. Renger

TECHNICAL ADVISORY COMMITTEE

A Technical Advisory Committee consisting of two Canada and two Manitoba members has been appointed to advise the Study Director. The Committee reviews Study proposals submitted to the Board and advises the Study Director as to scope and procedures required for program development. The Technical Advisory Committee has held fourteen meetings. Dr. A. Hamilton replaced Committee member Dr. J. R. Vallentyne in April, 1973, when the latter was appointed to the Board.

BOARD STAFF

The Board's staff of Study Director, Assistant Study Director, Study Planner, Administrative Officer, Clerk and Field Co-ordinator direct, co-ordinate and administer the program.

The Board has maintained offices in the Taylor Building, 693 Taylor Avenue, Winnipeg, since February 1, 1972.

The Study Director and his staff have scheduled, organized and co-ordinated all meetings and workshops conducted on behalf of the Board. Clerical and accounting procedures required by the Study have been developed jointly with the Department of Mines, Resources and Environmental Management. Computer services, drafting and general administrative support have also been provided by that Department.

Mr. D. C. Windsor, Field Co-ordinator, was replaced in June, 1973, by Mr. P. Wood to co-ordinate Study field activities.

The co-ordinated field program has significantly improved the effectiveness and efficiency of studies contracted by the Board. Mr. Wood terminated his employment with the Study at the end of the 1973 summer field program.

BUDGET

Budgetary requirements and the financial status of the Board's program continue to be refined as the Study progresses. Board funds are reassigned as studies terminate and new studies are identified. To date, approximately $1.4 million have been expended by the Board.

A detailed accounting of costs, expenditures and projected funding for completion of the Board's program is provided in Table 1.

Table 1. Financial Statement as of December 15, 1973

	Expended	Projected	Total
Mapping	$ 196,375	$ 6,500	$ 202,875 [1]
Water Quality	1,175	725	1,900
Hydrologic, Hydraulic & Geomorphologic Studies			
- Physical Impact	107,050	22,250	129,300
- Channel Studies	11,600	6,905	18,505
- Bank Stability Studies	7,795	9,505	17,300
- Shoreline Erosion Sand Movement	79,090	17,635	96,725
- Real Property Assessment, Dyking Investigations	14,200	---	14,200
- Community Water Supply	---	4,500	4,500
- Water Level & Flow Data Interpretation	19,250	11,750	31,000
- East Channel Hydraulic Study	3,675	2,825	6,500
Soils, Land-Use	40,000	2,000	42,000
Fisheries - Limnology	231,490	68,790	300,280
Wildlife	90,325	64,675	155,000
Geology	51,200	---	51,200
Recreation - Lake Winnipeg Demand	15,030	---	15,030
- Northern Manitoba	44,455	23,145	67,600
Forestry	17,015	6,310	23,325
Archaeology	92,950	---	92,950
Navigation - Transportation	25,840	8,470	34,310
Timber Clearing	5,585	14,415	20,000
Hydro-Electric Aspects	---	30,000	30,000
Socio-Economic Program	75,300	125,000	200,300
Administration	164,635	143,675	308,310
- Co-ordinated Field Program	92,700	3,400	96,100
Sub-Totals	$ 1,386,735	$ 572,475	$ 1,959,210
Less Manitoba Hydro's share of mapping[1]			41,000 CR
			$ 1,918,210
Contingency			81,790
Total			$ 2,000,000

[1] Manitoba Hydro's share (25% of $164,000) $41,000, is included.

THE NELSON RIVER HYDROELECTRIC DEVELOPMENT PROGRAM

Manitoba Hydro's proposed sequence for Nelson River power development involves, respectively, Lake Winnipeg regulation and Churchill River diversion from Southern Indian Lake to the Nelson River.

Regulation of Lake Winnipeg will be achieved by increasing the outflow capacity and by building a control structure and generating station at Jenpeg on the West Channel of the Nelson River (Fig. 1). The Churchill River will be diverted by a control dam at Missi Falls at the outlet of Southern Indian Lake and a diversion channel from South Bay on Southern Indian Lake to Issett Lake, the headwaters of the Rat River. A control structure at the outlet of Notigi Lake on the Rat River will regulate the release of water diverted from the Churchill River to the Nelson River (Fig. 2). Hydroelectric power will be produced at generating stations situated along the Churchill River diversion route and the Nelson River (Fig. 3).

LAKE WINNIPEG REGULATION

Manitoba Hydro has been authorized by an interim license issued under the Water Power Act to regulate Lake Winnipeg between elevations 711 feet and 715 feet. Under severe drought conditions the lake level could fall below the lower limit of the authorized range of regulation. In the event of a major flood, the upper limit could be exceeded.

Channels required to increase the outflow capacity from Lake Winnipeg are in various stages of construction. The channel improvements at Kisipachewuk Rapids have been completed and excavation of the Ominawin By-pass Channel is in its final stages. Approximately 60% of the dredging required for the Eight-mile Channel has been completed and excavation required for the Two-mile Channel will begin in early 1974. Construction of the main dam and spillway at Jenpeg is well advanced. The timber clearing program for the area to be inundated as a consequence of the reservoir formed by the Jenpeg control structure is approximately 90% complete.

Control works required for Lake Winnipeg regulation are scheduled to be operational by November, 1974. Hydroelectric power generation at Jenpeg is scheduled for early 1976.

CHURCHILL RIVER DIVERSION

Works required for the control of Southern Indian Lake and the diversion of the Churchill River to the Nelson River via the Rat and Burntwood Rivers are now under construction. Site preparation and investigations required for the construction of Manitoba Hydro's control works at Missi Falls and Notigi Lake are in progress. Clearing of timber along the diversion route from South Bay on Southern Indian Lake to Issett Lake in the headwaters of the Rat River has been completed. Contracts for construction of the diversion channel have been awarded by Manitoba Hydro and excavation is scheduled to be completed in 1975.

The license issued authorizes Manitoba Hydro to regulate Southern Indian Lake between elevations 844 feet and 847 feet, and divert up to 30,000 cfs from the Churchill River to the Nelson River via the Rat and Burntwood rivers. This authorization provides that

(a) during periods when the level of Southern Indian Lake is above elevation 847 feet, Manitoba Hydro shall operate the Missi Falls and Notigi control structures to effect the maximum discharge possible until the lake level returns to elevation 847 feet,

(b) Manitoba Hydro shall regulate Southern Indian Lake so as to prevent the lake level from receding below elevation 844 feet,

(c) the flow in the Burntwood River at Thompson shall not exceed 30,000 cfs plus the long term average flow.

(d) releases from the Missi Falls control structure shall not be less than 500 cfs during the open water period and 1500 cfs during the ice cover period.

(e) any change in rate of outflow from either control structure shall not exceed 10,000 cfs in any 24-hour period,

(f) the drawdown on Southern Indian Lake shall not exceed two feet in any 12-month period, and

(g) the water level immediately upstream of the Notigi control structure shall not decline to less than elevation 838 feet.

STUDY AREA

The Study area encompasses Lake Winnipeg and major portions of the Churchill and Nelson Rivers. The Board has specified five geographical areas for study on the basis of (a) the location of Manitoba Hydro's proposed developments and (b) environmental impacts associated with these developments (Fig. 4).

AREA I - LAKE WINNIPEG

The outflow capacity of Lake Winnipeg will be increased and a control structure will be installed at Jenpeg on the West Channel of the Nelson River to regulate the lake. This change in outlet configuration and pattern of outflow will alter the pattern of Lake Winnipeg levels from those that would occur without regulation.

AREA II - OUTLET LAKES

The pattern of water levels and flows will be altered in the lakes and the Nelson River channels above and below the Jenpeg control structure. Specific waters of concern in the Outlet Lakes area include the East and West channels of the Nelson River, Kiskitto Lake, Kiskittogisu Lake, Playgreen Lake, Pipestone Lake and Cross Lake. The location of Manitoba Hydro's control works in the Outlet Lakes area is shown in Fig. 1.

AREA III - DIVERSION ROUTE

Diversion of the Churchill River will introduce additional water to the Rat and Burntwood Rivers. This will greatly increase flows in these rivers and will alter the water levels in these channels. The pattern of flows, water level fluctuations and water quality will also be significantly changed in these rivers. In addition, the Notigi control structure and the proposed hydroelectric power projects along the diversion route will flood land and form new shorelines.

AREA IV - SOUTHERN INDIAN LAKE

The mean level of Southern Indian Lake will be increased by approximately 10 feet following completion of the Missi Falls and Notigi control works. Raised lake levels will increase the total water surface area of Southern Indian Lake and Opachuanau Lake by approximately 22% to 600,000 acres (940 square miles). The Notigi forebay will further increase the total water surface area by approximately 150,000 acres (230 square miles). The current water surface area in the reach of the diversion route from South Bay to the Notigi control structure is approximately 40,000 acres (62 square miles).

AREA V - LOWER CHURCHILL RIVER

Diversion of 30,000 cfs out of Southern Indian Lake will significantly alter the quantity and pattern of flow in the Churchill River downstream from Missi Falls, and, consequently, the pattern of water level fluctuation.

STUDIES, INVENTORIES AND RELATED INVESTIGATIONS

Studies, inventories and related investigations initiated by the Board have been undertaken primarily to assess the impact of Manitoba Hydro's works at Missi Falls and Notigi Lake, the power developments proposed for Wuskwatim, Manasan and First Rapids, and the works required for Lake Winnipeg regulation. Contractual arrangements respecting Study components, areas for investigation, duration of studies and contract agencies are summarized in Fig. 5.

Mapping requirements for studies of the effect of the regulation of Lake Winnipeg, and the diversion and hydroelectric development on the Burntwood River have been completed.

Monitoring associated with water quality, sand movement and shoreline erosion has been continued as an integral part of the Board's program.

Biophysical, geological and archaeological inventories have been completed. Forest inventories for lands bordering Southern Indian Lake, the Rat River and the Outlet Lakes have also been completed. The forest inventory of the area to be flooded along the Burntwood River is in its final stage. Analyses and evaluations based on these inventories are in progress.

New studies specifically designed to interpret effects of Manitoba Hydro's works in areas in close proximity to remote communities were initiated this year.

Studies of a general nature including fisheries, wildlife and recreation are progressing as scheduled as well as numerous other studies concerning site-specific aspects of the Nelson River development program.

The Board co-operated with the Canada Center for Remote Sensing to obtain photography of parts of the Study area to aid in establishing "baseline" conditions.

A summary of the Study components is presented in the following table.

SUMMARY OF STUDY COMPONENTS

STUDY COMPONENT	CONTRACT AGENCY	OBJECTIVE	INVESTIGATION AREA
MAPPING	Manitoba Surveys, Mapping & Lands Branch	To accurately define lake shoreline contours. To define anticipated areas of flooding.	Lake Winnipeg Shoreline (South Basin) Diversion Route
HYDROLOGIC, HYDRAULIC & GEOMORPHOLOGIC STUDIES			
(a) Physical Impact Study	Manitoba Water Resources Branch	To determine anticipated physical changes to river & lake characteristics.	Churchill & Nelson River systems and Selected Reservoirs
(b) Channel Studies	Manitoba Water Resources Branch	To determine specific effects on the physical environment as a result of channel construction. To review channel work giving due regard to design modifications & new information.	Two-mile and Eight-mile Channels South Bay to Issett Lake Channel Eight-mile Channel
(c) Bank Stability Studies	Manitoba Water Resources Branch	To determine the effects of the hydroelectric development on the stability of lake & river shorelines in close proximity to northern communities.	Burntwood River (Thompson) Nelson House Settlement South Indian Lake Settlement Cross Lake Settlement

STUDY COMPONENT	CONTRACT AGENCY	OBJECTIVE	INVESTIGATION AREA
(d) Shoreline Erosion & Sand Movement Study	Manitoba Water Resources Branch	To determine sand movement & shoreline erosion.	Lake Winnipeg (South Basin)
(e) Real Property Assessment	Manitoba Water Resources Branch	To assess anticipated effects of increased water levels on real property. To determine the effect of Lake Winnipeg regulation on a temporary dyking system.	Outlet Lakes Southern Indian Lake & Diversion Route Lake Winnipeg (dyking system)
(f) Community Water Supply	Manitoba Environmental Protection Branch	To determine changes in quantity & quality of water required for domestic & industrial uses.	Cross Lake & Norway House Churchill & Thompson Nelson House, South Indian Lake, Leaf Rapids
(g) Water Levels & Flows, Data Interpretation	Manitoba Water Resources Branch	To interpret hydrologic data provided from Manitoba Hydro's systems analysis.	Study Area
(h) Hydraulic Study	Manitoba Water Resources Branch	To predict changes in the hydraulic characteristics of the East Channel as a consequence of a proposed control structure.	East Channel (Nelson River)
NAVIGATION - TRANSPORTATION	University of Manitoba	To determine implications to navigation & transportation resulting from the proposed hydroelectric development.	Outlet Lakes Study Area (General) Southern Indian Lake & Diversion Route

STUDY COMPONENT	CONTRACT AGENCY	OBJECTIVE	INVESTIGATION AREA
RECREATION	Manitoba Department of Tourism, Recreation & Cultural Affairs	To determine the effects of Hydro's power development on recreation potential.	Lake Winnipeg Outlet Lakes Southern Indian Lake Diversion Route
FORESTRY (a) Timber Inventory	Manitoba Department of Mines, Resources & Environmental Management	To determine quality, & quantity of timber to be inundated.	Outlet Lakes Southern Indian Lake Rat River Burntwood River
(b) Growth Study	Manitoba Department of Mines, Resources & Environmental Management	To assess the impact of flooding on growth of timber situated in close proximity to newly established shorelines.	Cedar Lake Sipiwesk Lake
GEOLOGY	Manitoba Mines Branch	To conduct geological inventories in areas prior to flooding.	West Channel of the Nelson River & Kiskittogisu Lake Areas Ospwagan Lake Area
SOILS, LAND-USE	University of Manitoba, Manitoba Soil Survey	To provide land classification & planimetric data pertinent to a description of soils, land forms & vegetation.	Outlet Lakes Area Diversion Route) Southern Indian) Lake)

STUDY COMPONENT	CONTRACT AGENCY	OBJECTIVE	INVESTIGATION AREA
FISHERIES - LIMNOLOGY	Freshwater Institute, Environment Canada	To determine the effects of Hydro's program on fisheries.	Outlet Lakes Southern Indian Lake Churchill River) Diversion Route) Lake Winnipeg)
WILDLIFE	F. F. Slaney & Company Limited	To determine the effects of Hydro's program on wildlife habitat & populations.	Outlet Lakes Southern Indian Lake Churchill River) Diversion Route) Lake Winnipeg)
ARCHAEOLOGY	Archaeological Research Centre, University of Winnipeg	Identify archaeological sites where flooding is anticipated.	Outlet Lakes Diversion Route
TIMBER CLEARING	F. F. Slaney & Company Limited & Study Office	To determine timber clearing implications & requirements.	Study Area Outlet Lakes Southern Indian Lake Diversion Route
SOCIO-ECONOMIC (a) Program Planning	Acres Consulting Services Limited & Harry Hill Consulting Limited	Program planning & systems development with emphasis on socio-economic requirements.	Study Area

STUDY COMPONENT	CONTRACT AGENCY	OBJECTIVE	INVESTIGATION AREA
(b) Preliminary Studies			
- Demographic Survey	Acres Consulting Services Limited	Demographic data review & compilation.	Study Area
- Literature Review	Acres Consulting Services Limited	Review of pertinent literature.	General
- Indian Affairs Survey	Acres Consulting Services Limited	To co-operate with Indian Affairs in completing demographic surveys.	Norway House/) Rossville) Cross Lake) South Indian Lake) Nelson House) Warren Landing)
- South Indian Lake Impact	Canada-Manitoba Social and Economic Study Team	To describe some of the socio-economic implications of the proposed hydro-electric development.	South Indian Lake Settlement
(c) Socio-Economic Study	Canada-Manitoba Social and Economic Study Team	To determine socio-economic effects of the proposed hydroelectric development.	Study Area
WATER QUALITY MONITORING PROGRAM	Manitoba Environmental Protection Branch (co-ordinating Agency)	To provide a water quality data base to assess changes in water quality.	Selected sites throughout the Study Area
REMOTE SENSING	Canada Centre for Remote Sensing	To provide photography of the "natural" state prior to completion of the hydro-electric development.	Selected sites throughout the Study Area

1973 STUDY PROGRESS AND HIGHLIGHTS

In a number of Study sectors, progress to date has enabled the Board to interpret effects of regulation of Lake Winnipeg and diversion of the Churchill River, to identify new problem areas and to consider methods and areas for remedial and mitigation measures. Particular attention has been given by the Board to areas and recommendations requiring immediate action by Manitoba Hydro and the respective governments. Many recommendations, particularly those requiring action in the longer term, can be more appropriately and accurately described in the final report following completion of all studies.

MAPPING

Lake Winnipeg mapping required for Board studies of beach erosion and shoreline erosion associated with Lake Winnipeg regulation was completed in June, 1972.

Contour mapping by which to generally delineate the area along the Burntwood River (Notigi Lake to Thompson) to be influenced by Churchill River diversion and the proposed development of hydroelectric sites (Wuskwatim and Manasan) was completed in March, 1973. This contour information and data on river levels and flows and associated ice regime have been used to delineate the impact area along the diversion route.

The contour maps have been made available for public distribution.

WATER QUALITY MONITORING PROGRAM

The Manitoba Environmental Protection Branch continued to co-ordinate the activities of numerous government agencies in the collection, consolidation and reporting of water quality data obtained during 1973. This program is being conducted at little cost to the Board. However, valuable information is being made available to assist in fisheries, wildlife, recreation and other studies.

The Manitoba Environmental Protection Branch, on advice from the Board, has expanded water quality monitoring activities in site-specific areas (e.g. Eight-mile Channel) to determine the effect of Manitoba Hydro's construction activities on water quality.

The Board has identified a need for an expanded program of water quality assessment as part of a continuing and more comprehensive long term study of ecological changes attributed to the Nelson River development program and recommendations were forwarded to the two governments.

CHANNEL STUDIES

Two areas of major concern have been identified during studies of the effect of construction and operation of channels (Eight-mile, Two-mile, Ominawin, Kisipachewuk, South Bay to Issett Lake) required for Lake Winnipeg regulation and Churchill River diversion. These are

(1) environmental degradation and resource losses associated with distribution of dredge spoil,

and (2) erosion, sedimentation and associated deterioration in water quality.

Deposition of spoil material adjacent to the Eight-mile Channel has altered the landscape considerably. In addition, the dredging operation in the Eight-mile Channel has caused some increase in turbidity in Kiskittogisu Lake. However, this condition will be limited to the construction period. During the latter part of the summer of 1973, vegetative growth on the spoil piles was observed. As the area covered by vegetation increases the aesthetics will improve and the likelihood of soil erosion will be lessened. Effects of the dredging operation in the Two-mile Channel, which is to be undertaken during the spring and summer of 1974, are expected to be similar.

More land will be flooded around Kiskittogisu Lake than was originally anticipated. However, a preliminary assessment of the resources in the area and their current and anticipated use indicates that a definitive evaluation of the amount of land to be flooded around Kiskittogisu Lake is unwarranted.

Effects attributed to Manitoba Hydro's work in the Kiskittogisu Lake area are local in nature. These local effects, while having a significant impact on landscape in the immediate vicinity of the construction works, have little social and economic significance.

KISKITTO LAKE REGULATION

Manitoba Hydro's design plans for Kiskitto Lake regulation have been examined with a view to assessing project impact on resources and the environment in order to recommend measures that will enhance the benefits of Kiskitto Lake regulation. A design modification permitting more flexible lake level control has been recommended to Manitoba Hydro as a means of enhancing project benefits in this area particularly to wildlife. Manitoba Hydro has incorporated the recommended design modification in its plans for Kiskitto Lake regulation. Provincial and federal agencies have been requested to provide Manitoba Hydro with guidelines to optimize development and management of Kiskitto Lake resources.

EAST CHANNEL CONTROL (Nelson River)

A preliminary environmental impact assessment and a hydraulic study have been undertaken to assist Manitoba Hydro in its study of the feasibility of constructing control works on the East Channel of the Nelson River. Further analyses may be required following completion of Manitoba Hydro's feasibility study.

BANK STABILITY STUDIES

Studies to determine the effects of altered water levels and flows attributed to Lake Winnipeg regulation and Churchill River diversion on the stability of shorelines in close proximity to the City of Thompson and the communities of South Indian Lake, Nelson House and Cross Lake have identified the need for relocation or protection of real properties such as docking facilities, bridges, cemeteries and local roads.

COMMUNITY WATER SUPPLY STUDIES

Studies concerning the effect of the Nelson River development program on water supply and waste treatment facilities at Thompson, Churchill, Leaf Rapids, South Indian Lake, Nelson House, Cross Lake and Norway House are in various stages of completion.

Norway House and Cross Lake water supply and waste treatment facilities will be relatively unaffected by altered water levels and flows resulting from Lake Winnipeg regulation. However, if in the future control works are constructed on the East Channel, adverse effects on the water supply to those communities might occur. Such adverse effects would be limited to low flow periods in the East Channel.

Implications of the Churchill River diversion to the Town of Churchill include interference with the intake structure for the water supply system, increased corrosion to the exterior of the water supply pipe, and changes in color and hardness of the water.

Increased chemical treatment of water supplied for municipal use at Thompson, treatment of water required for industrial purposes, and possible relocation of the pumphouses in the Thompson area have been identified as possible effects of the Churchill River diversion. Further investigations will be required to determine the effects of the diversion on water supply and waste treatment facilities at the Pipe Lake Mine.

REAL PROPERTY STUDIES

Inventories of real properties to be affected by changed water levels attributed to Lake Winnipeg regulation and Churchill River diversion have been made. Present real property values have been determined. Estimates of the changes in real property values are being made recognizing the probability, frequency and duration of altered water levels.

TIMBER CLEARING INVESTIGATIONS

The Board developed general guidelines for timber clearing within areas affected by Lake Winnipeg regulation and the Churchill River diversion. These guidelines were presented to the Ministers and the Chairman of Manitoba Hydro in a report titled "General Guidelines - Timber Clearing". The Board recommended that the report be released to the public.

Subsequent to the development of general timber clearing guidelines, the Board initiated studies with a view to identifying site-specific timber clearing requirements to mitigate damages caused by Lake Winnipeg regulation and Churchill River diversion. Assessment of specific timber clearing requirements by the Study participants is in progress in the Outlet Lakes area, around Southern Indian Lake and along the Churchill River diversion route.

FISHERIES, WILDLIFE AND RECREATION

Fisheries, wildlife and recreation studies are progressing as scheduled. The relatively extensive field studies required in these sectors have been completed.

Fisheries activities in 1973 focused on field studies on the lower Churchill River and along the diversion route, and on analysis and evaluation of data collected in 1972 on Southern Indian Lake.

Wildlife and recreation studies and reporting gave priority to investigations in the Southern Indian Lake and Rat-Burntwood areas, respectively. Preliminary analyses of results have identified the need for a more precise estimate of water level changes to better evaluate (a) environmental impacts attributed to Manitoba Hydro's works, and (b) possible mitigation measures and compensation.

ARCHAEOLOGY

Archaeological studies were not funded by the Board in 1973. However, archaeological inventories were made by others in 1973 in areas of the Churchill River diversion route, Kiskittogisu Lake and the West Channel of the Nelson River. Thirty-two sites were examined. Sites were assigned importance according to their cultural content, elevation above water level and degree of undisturbed stratigraphy. Seven of the 32 sites were recommended for intensive excavation. Manitoba Hydro is currently funding excavation work at these seven sites. Other intensive archaeological investigations are in progress in the area to be flooded around Southern Indian Lake at sites identified through earlier Board studies.

The archaeology inventory has provided material that suggests early habitation of this area, possibly Early Man (8000 B.C. - 4000 B.C.) to Early Historic times and perhaps provides evidence of a North West Company trading post in this area.

Archaeological investigations in areas of Kiskittogisu Lake and the West Channel of the Nelson River produced little material of archaeological significance.

SOCIO-ECONOMIC STUDIES

A preliminary study of socio-economic implications associated with those aspects of the Churchill River diversion which affect the community at South Indian Lake has indicated four major areas of immediate concern:

(1) the need for broad northern development strategies which would incorporate those aspects related to hydroelectric development,

(2) improved mechanisms for community participation, communication and involvement in decision making processes,

(3) community involvement in determining uses of local resources, and

(4) clarification of "developer" roles and responsibilities with a view to possible future mitigation, compensation and adjustment procedures.

Social and economic studies are currently in progress for the communities of Nelson House, Cross Lake and Norway House. Where feasible, assessment of regional implications of the Nelson River development program comprises part of the socio-economic program.

COMPLETED REPORTS AND MAPPING

The reports and maps which have been completed to date under the direction of the Board are listed in the following tabulation.

COMPLETED REPORTS AND MAPPING

TITLE	DESCRIPTION	DATE COMPLETED
Progress Report Number 1, December 31, 1971	Report on Study progress to December 31, 1971.	January, 1972
Physical Impact Study : Interim Report 1972	A description of the characteristics of shorelines in the Churchill-Nelson River system, and the impact of existing impoundment and diversion projects in the general region.	January, 1973
Progress Report Number 2 December 31, 1972	Report on Study progress to December 31, 1972.	February, 1973
Social and Economic Impact of the Nelson River Hydro Development (with emphasis on South Indian Lake)	An evaluation of the social and economic impact of the Nelson River hydroelectric development program on northern communities with emphasis on South Indian Lake.	June, 1973

TITLE	DESCRIPTION	DATE COMPLETED
General Guidelines - Timber Clearing	A development of general guidelines to be used to formulate timber clearing programs in the areas to be affected by Lake Winnipeg regulation and Churchill River diversion	October, 1973
Impact Analysis of Kiskitto Lake Regulation	An assessment of impact of Kiskitto Lake regulation with a view to suggesting project design modifications which would enhance the overall benefits.	October, 1973
Mapping - Lake Winnipeg	Topographic mapping extending from Riverton around the south pool of Lake Winnipeg to Traverse Bay. The mapping extends from the shoreline to 3000 feet inland and is to a horizontal scale of 1:2400 with a contour interval of two feet.	June, 1972
Mapping - Diversion Route	Mapping of the Thompson to Notigi Lake area at a horizontal scale of 1:12,000 with a contour interval of 10 feet on a rectified photographic mosaic base.	March, 1973

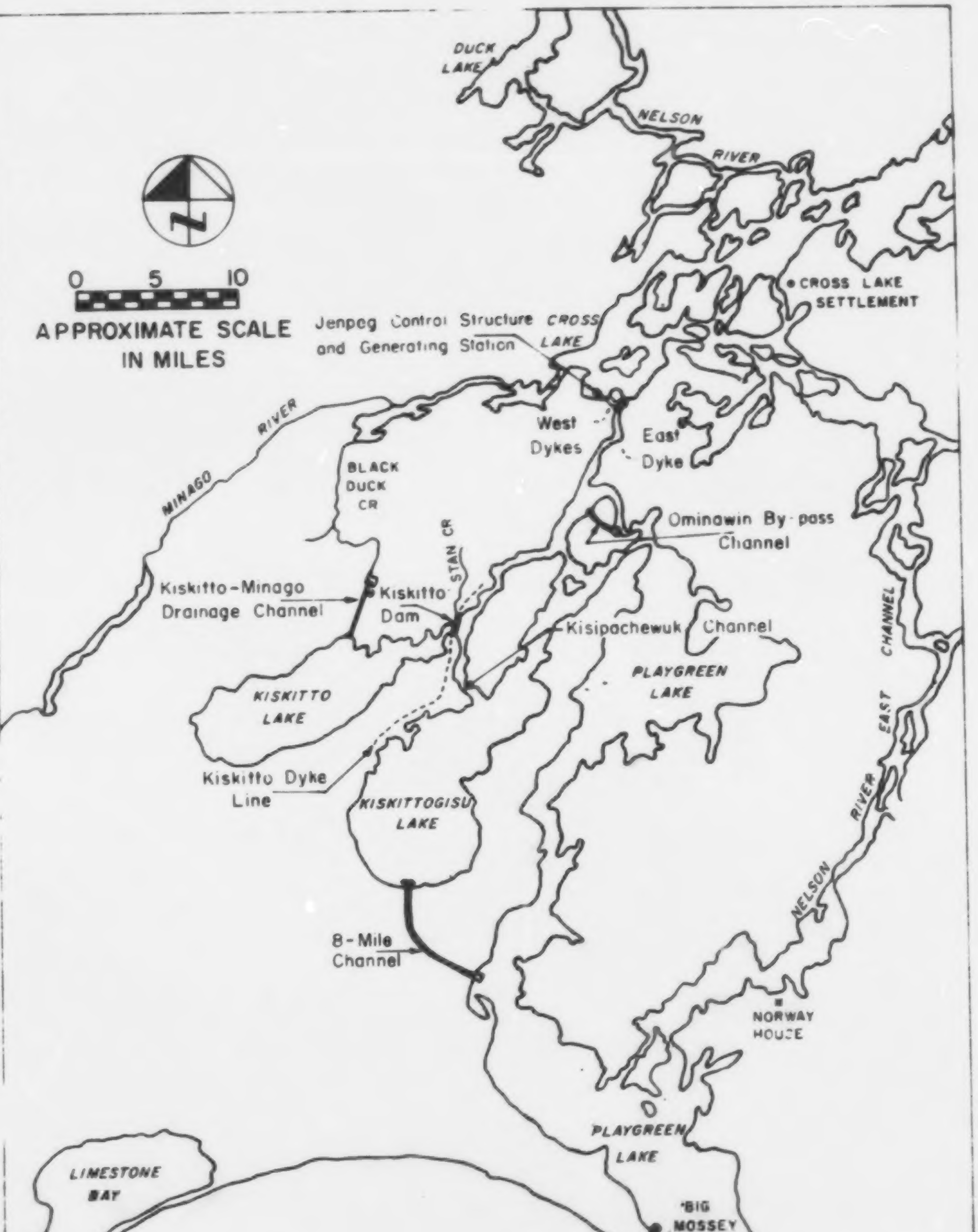


FIG. 1. LAKE WINNIPEG REGULATION.

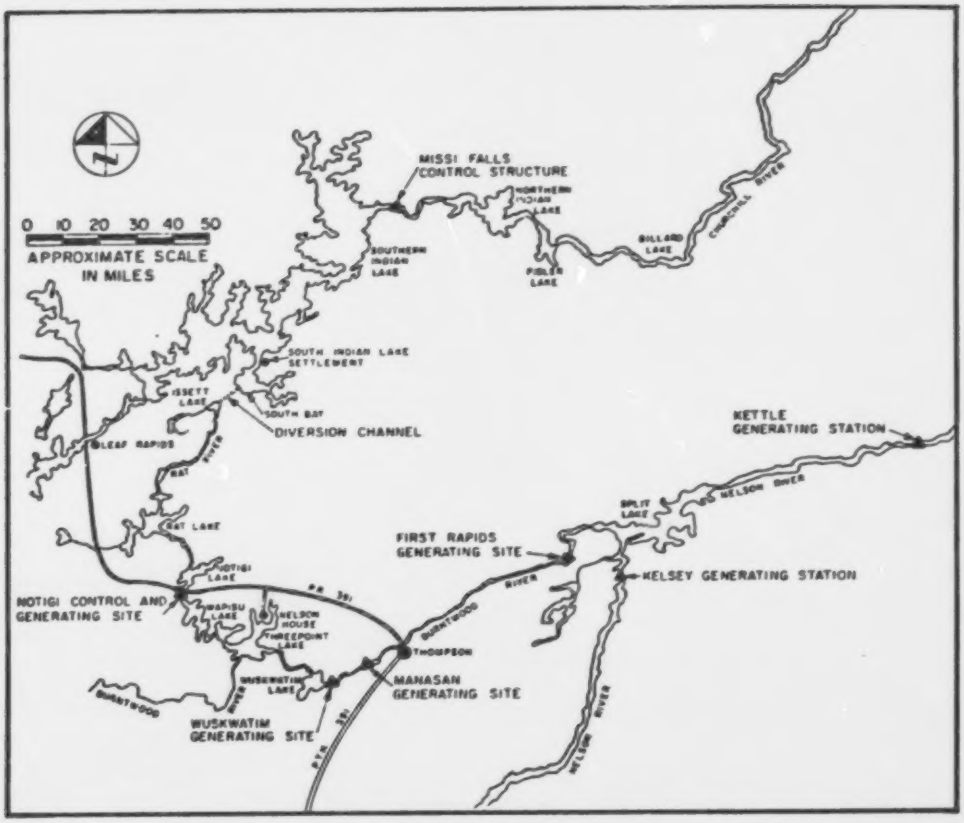


FIG. 2. .CHURCHILL RIVER DIVERSION.

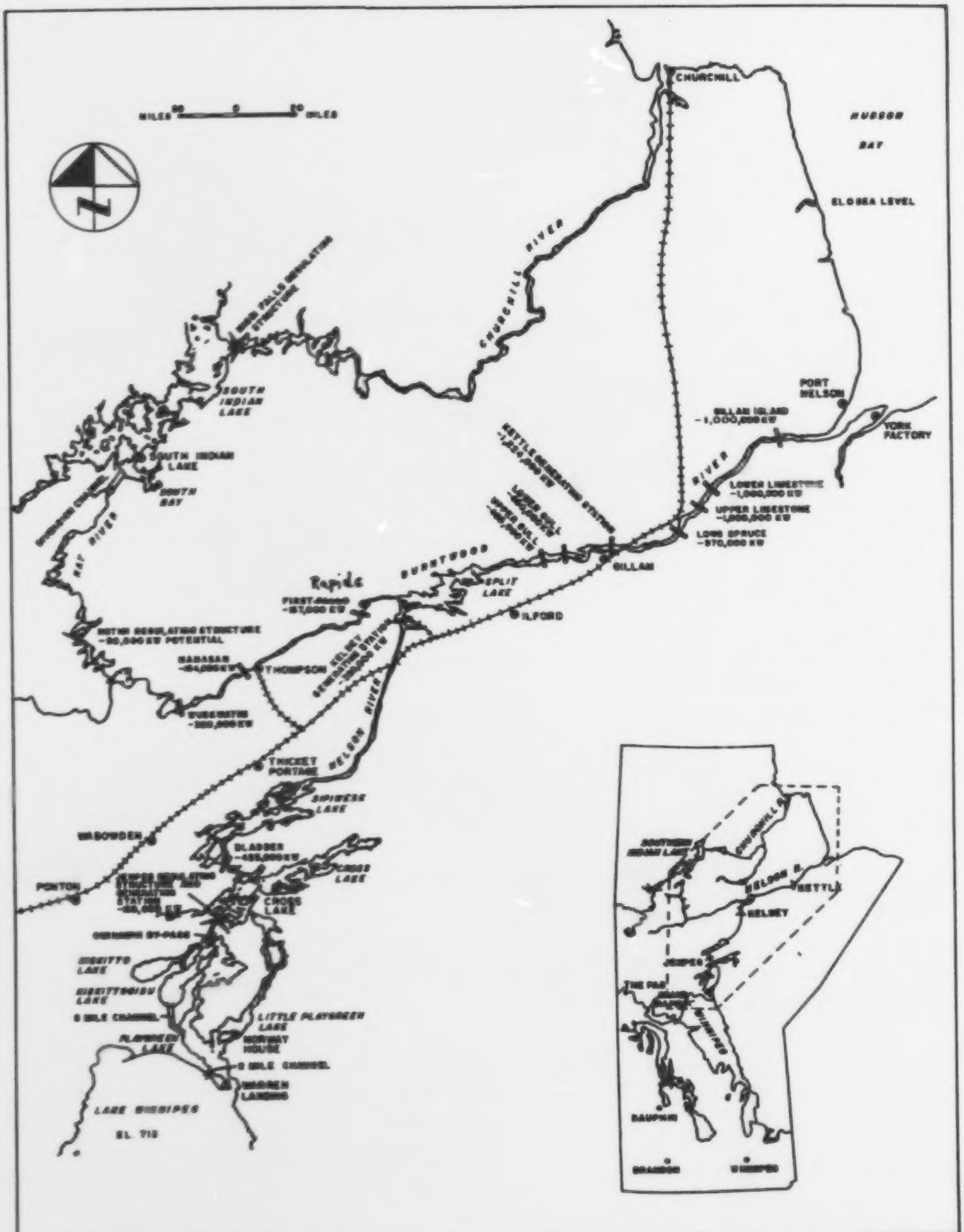


FIG. 3. PROPOSED HYDROELECTRIC DEVELOPMENT OF THE NELSON RIVER SYSTEM IN NORTHERN MANITOBA.

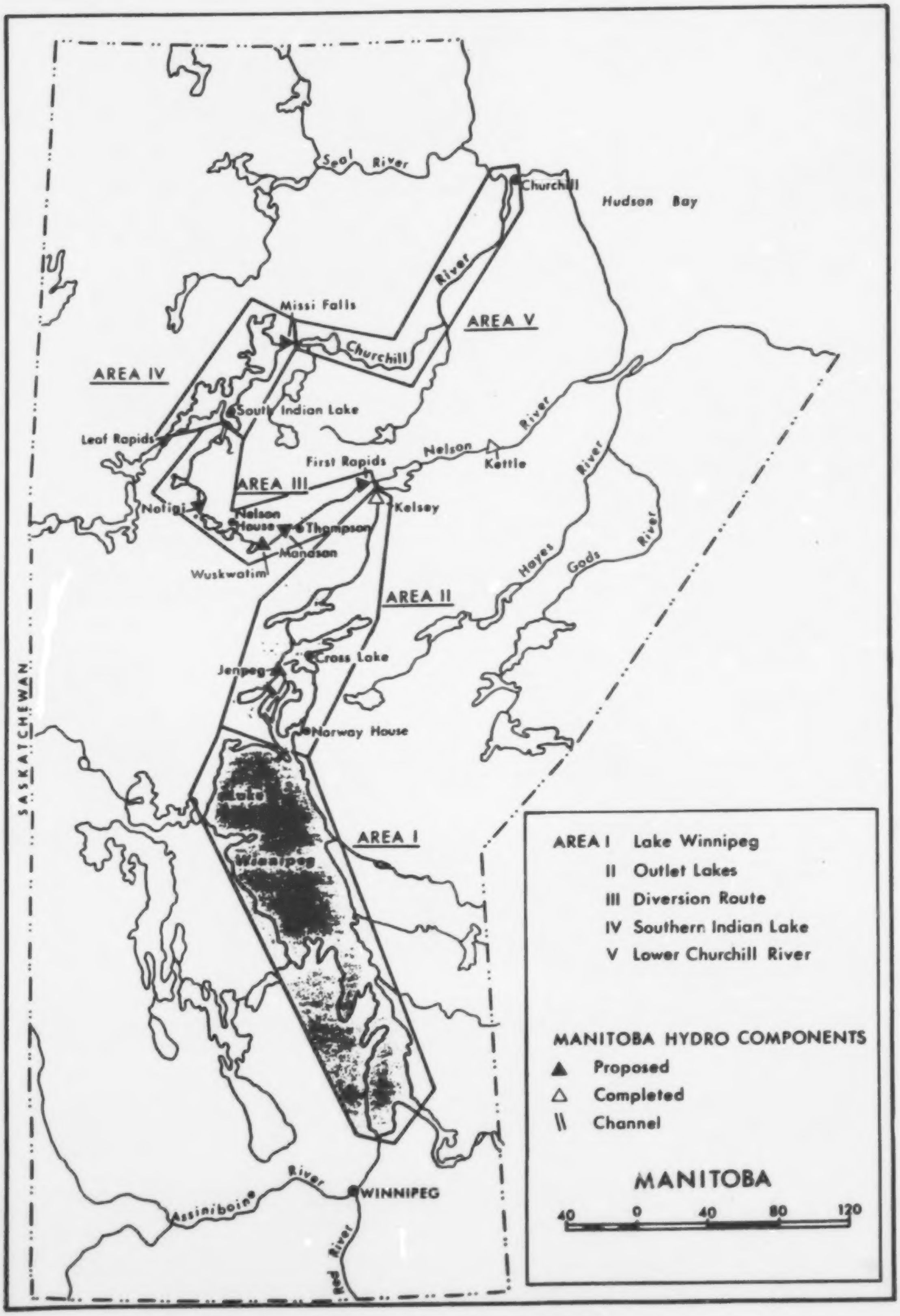
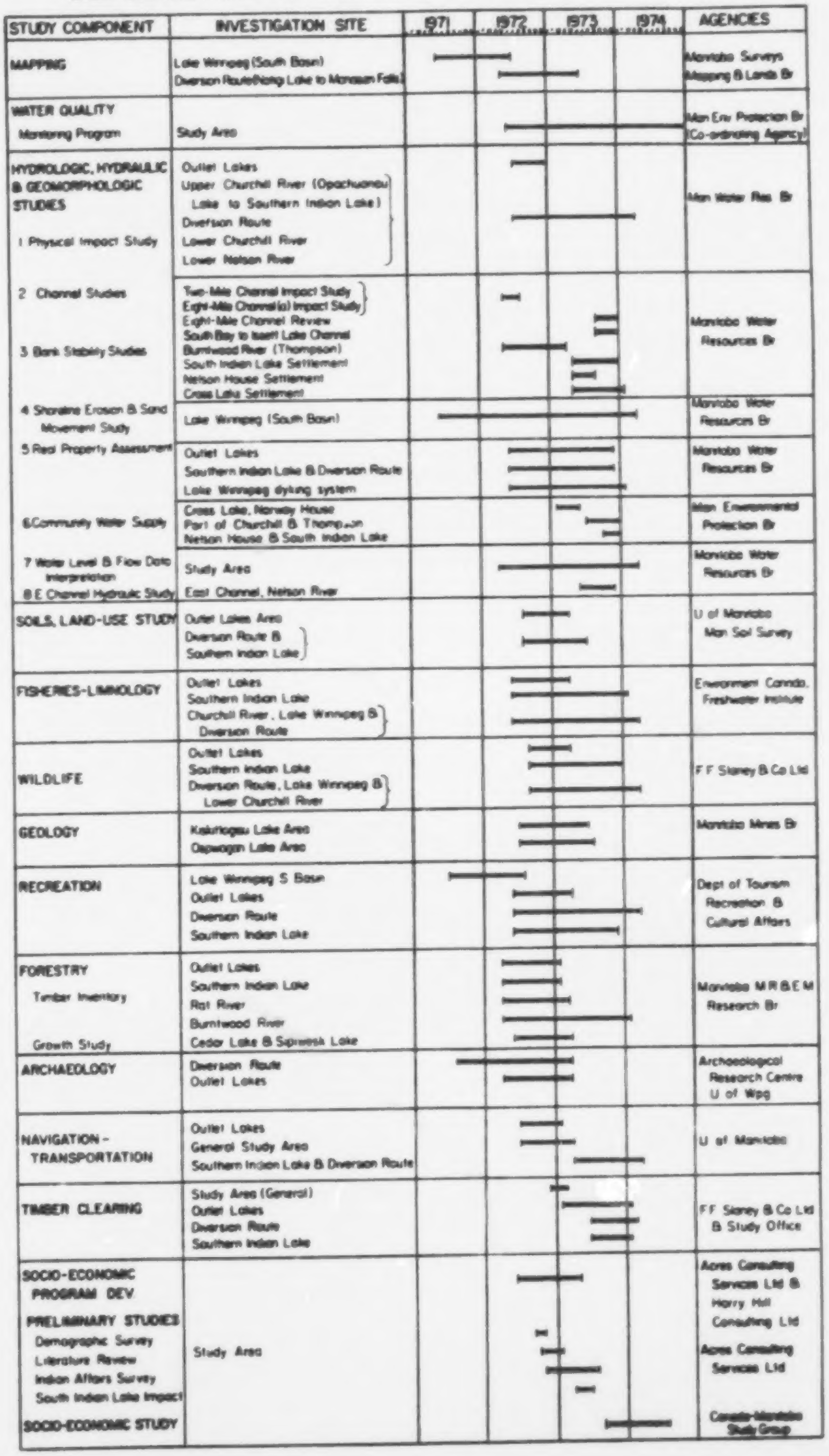


FIG. 4 LOCATION PLAN OF STUDY AREAS

FIGURE 5.

LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY

STUDY COMPONENTS, AREAS OF INVESTIGATION, STUDY PERIODS, CONTRACT AGENCIES



STUDY COMPONENT	INVESTIGATION SITE	AGENCIES
MAPPING	Lake Winnipeg (South Basin)	Manitoba Surveys Mapping & Lands Br
	Diversion Route (Notigi Lake to Manasan Falls)	
WATER QUALITY Monitoring Program	Study Area	Man Env Protection Br (Co-ordinating Agency)
HYDROLOGIC, HYDRAULIC & GEOMORPHOLOGIC STUDIES	Outlet Lakes	Man Water Res. Br
1 Physical Impact Study	Upper Churchill River (Opachuanau Lake to Southern Indian Lake) Diversion Route Lower Churchill River Lower Nelson River	
2 Channel Studies	Two-Mile Channel Impact Study Eight-Mile Channel(s) Impact Study	Manitoba Water Resources Br
	Eight-Mile Channel Review	
	South Bay to Issett Lake Channel	
3 Bank Stability Studies	Burntwood River (Thompson)	
	South Indian Lake Settlement	
	Nelson House Settlement	
	Cross Lake Settlement	
4 Shoreline Erosion & Sand Movement Study	Lake Winnipeg (South Basin)	Manitoba Water Resources Br
5 Real Property Assessment	Outlet Lakes	Manitoba Water Resources Br
	Southern Indian Lake & Diversion Route	
	Lake Winnipeg dyking system	
6 Community Water Supply	Cross Lake, Norway House	Man Environmental Protection Br
	Part of Churchill & Thompson	
	Nelson House & South Indian Lake	
7 Water Level & Flow Data Interpretation	Study Area	Manitoba Water Resources Br
8 E Channel Hydraulic Study	East Channel, Nelson River	
SOILS, LAND-USE STUDY	Outlet Lakes Area	U of Manitoba Man Soil Survey
	Diversion Route & Southern Indian Lake	
FISHERIES-LIMNOLOGY	Outlet Lakes	Environment Canada, Freshwater Institute
	Southern Indian Lake	
	Churchill River, Lake Winnipeg & Diversion Route	
WILDLIFE	Outlet Lakes	F F Slaney & Co Ltd
	Southern Indian Lake	
	Diversion Route, Lake Winnipeg & Lower Churchill River	
GEOLOGY	Kakinagau Lake Area	Manitoba Mines Br
	Oopwagan Lake Area	
RECREATION	Lake Winnipeg S Basin	Dept of Tourism Recreation & Cultural Affairs
	Outlet Lakes	
	Diversion Route	
	Southern Indian Lake	
FORESTRY Timber Inventory	Outlet Lakes	Manitoba M R & E M Research Br
	Southern Indian Lake	
	Rat River	
	Burntwood River	
Growth Study	Cedar Lake & Sipiwesk Lake	
ARCHAEOLOGY	Diversion Route	Archaeological Research Centre U of Wpg
	Outlet Lakes	
NAVIGATION - TRANSPORTATION	Outlet Lakes	U of Manitoba
	General Study Area	
	Southern Indian Lake & Diversion Route	
TIMBER CLEARING	Study Area (General)	F F Slaney & Co Ltd & Study Office
	Outlet Lakes	
	Diversion Route	
	Southern Indian Lake	
SOCIO-ECONOMIC PROGRAM DEV	Study Area	Acres Consulting Services Ltd & Harry Hill Consulting Ltd
PRELIMINARY STUDIES		
Demographic Survey		Acres Consulting Services Ltd
Literature Review		
Indian Affairs Survey		
South Indian Lake Impact		
SOCIO-ECONOMIC STUDY		Canada-Manitoba Study Group

APPENDIX 1 - M

IMPACT ANALYSIS OF KISKITTO LAKE REGULATION

IMPACT ANALYSIS
OF
KISKITTO LAKE REGULATION

by

I. W. DICKSON
Lake Winnipeg, Churchill and Nelson Rivers Study Office
Winnipeg, Manitoba
July, 1973

for

THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

July 30, 1973.

Mr. N. H. James, Chairman,
Lake Winnipeg, Churchill and
Nelson Rivers Study Board,
c/o Water Planning & Management Branch,
Environment Canada,
9th Floor, Place Vincent Massey,
St. Joseph Boulevard,
HULL, Quebec.

Dear Mr. James:

At the Board's request, Lake Winnipeg, Churchill and Nelson Rivers Study participants have given attention to the matter of Kiskitto Lake regulation as it may affect specific resources and the environment generally. Priority was given to analysis of impact of Kiskitto Lake regulation as Manitoba Hydro was finalizing design plans for these works. Report content rather than appearance and format have been emphasized in order to expedite analysis and reporting of environmental impact and recommendations for design modification to enhance overall benefits of the project. Data and recommendations contained herein will be reported in greater detail as part of the Outlet Lakes Interim Report.

Meetings of representatives of Manitoba Hydro and appropriate resource disciplines were held to consider design plans for Kiskitto Lake regulation and alternatives for enhancing project benefits. Analyses of this issue were limited by lack of primary data specific to this individual water body. Participants were required, therefore, to determine and evaluate project effects primarily on the basis of professional judgement and experience from like situations.

The recommendation tc construct stop-log control works in the outlet channel was formulated based on the premise that wildlife could make better use of the lake if greater lake level fluctuations were permissible. The stop-log control works will allow for exploration and development of these as yet undefined wildlife management opportunities.

Yours truly,

I. W. Dickson

I. W. Dickson,
STUDY DIRECTOR.

Enc.

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IMPACT ANALYSIS OF KISKITTO LAKE REGULATION

JULY 30, 1973.

INTRODUCTION

Manitoba Hydro will regulate Kiskitto Lake as part of the proposed scheme for Lake Winnipeg regulation. Kiskitto Lake regulation as proposed by Manitoba Hydro will prevent extensive flooding in the immediate area of Kiskitto Lake and may create increased opportunities for research, development and management of natural resources characteristic of this area. Participants of the Lake Winnipeg, Churchill and Nelson Rivers Study examined the proposed scheme of Kiskitto Lake regulation with a view to minimizing detrimental aspects and enhancing benefits.

The following constitutes a brief summary of the Kiskitto Lake regulation project, nature and extent of project impact on resources in the area, design alternatives to minimize and enhance project impact, and recommendations.

KISKITTO LAKE REGULATION - THE PROJECT

The proposed plan for regulation of Kiskitto Lake has been described in detail by Manitoba Hydro[1]. Briefly the Kiskitto Lake regulation project as proposed by Manitoba Hydro calls for

(1) a small dam and associated dykes separating Kiskitto Lake from the West Channel of the Nelson River, the lake's natural outlet,

---

[1] *Proposals for Kiskitto Lake works are defined in "Interim Report on Regulation of Kiskitto Lake", May, 1972. The hydrology study on which the following analysis is based is also contained in this report.*

(2) outlet works comprising a rock weir and connecting channels which discharge in Black Duck Creek in the Minago River system, and

(3) a gated culvert through the cutoff dam to permit inflows from the West Channel as required.

Details of the proposed outlet control works are shown in Fig. 2.

Assuming no inflow other than local runoff, the rock weir with the crest at elevation 694.0 feet, as proposed by Manitoba Hydro, will maintain Kiskitto Lake water levels between elevation 695.2 feet and elevation 698.3 feet with the water level rarely dropping below elevation 696.0 feet. Kiskitto Lake water levels have been estimated to fluctuate between elevations 686.5 feet and 702.3 feet under natural conditions.

The range of regulation on Kiskitto Lake can of course be altered by operating the gated culvert in the Kiskitto Lake dam and importing water from the West Channel and changing the design of the outlet control works.

RESOURCES[2]

Resources associated with Kiskitto Lake and their uses may be described as generally limited. Potential opportunities for future resource development and management may be somewhat limited from a provincial viewpoint but may be of considerable importance to resource development in the local area.

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[2] *The discussion of resource impacts is based upon discussion with, and vested by, the appropriate study contractors.*

FISHERIES

Currently, approximately 17,000 pounds of fish, walleye, whitefish, goldeye and pike, are taken annually from Kiskitto Lake. Although some lake characteristics (size and depth) would suggest a fishery of greater potential than indicated by current production, this was not supported by results of a recent gill netting program. The Kiskitto Lake commercial fishery is about one-half that of neighboring Kiskittogisu Lake. Turbidity appears to be the factor limiting productivity of Kiskitto Lake. The annual value of the commercial fishery is approximately $10,000.

WILDLIFE

Canada Land Inventory maps indicate Kiskitto Lake to have a high potential for staging of waterfowl. Islands at the northeast end of Kiskitto Lake are of particular significance for this purpose. However, a recent brief survey of this area indicated that the staging potential was not being fully utilized.

RECREATION

Kiskitto Lake has limited recreational potential. However, increased accessibility to this area as a result of Manitoba Hydro's activities should enhance future recreational opportunities.

IMPACT OF THE PROPOSED MANITOBA HYDRO PROJECT

With regulation as proposed by Manitoba Hydro, outflows from Kiskitto Lake will discharge to Black Duck Creek. Some erosion is expected in the channel immediately below the rock weir and for some two miles along this channel. Erosion will dissipate downstream where Black Duck Creek widens considerably and, as such, will have little ecological implication. Kiskitto Lake regulation will significantly reduce the range of natural fluctuation (686.5 to 702.3) to a more narrow range of fluctuation (695.2 to 698.3). Further, lake levels will be maintained higher on average than under natural conditions (the weir will hold the lake at higher levels than under natural conditions for 90% of the time). When lake levels on Kiskitto Lake are high and inflow is negligible, the Black Duck Creek channel as proposed will provide for outflows which would lower the lake level by approximately 0.3 feet per month. Inflows permitted by the gated culvert in Kiskitto dam at the West Channel would not significantly affect the range of water level fluctuation because of the large lake size relative to the small inflows from the West Channel.

Kiskitto Lake regulation, by maintaining higher lake levels on average, can be expected to increase the fishery potential of these waters. Retarding the rather severe range of natural lake level fluctuation is also considered beneficial to the fishery. The development of a limited sport fishery at Kiskitto Lake primarily due to increased accessibility and to a lesser extent increased fishery productivity will provide new recreation opportunities in this area. Any aesthetic qualities related to recreational uses in this area would be enhanced by maintaining higher water levels provided that the water levels were not raised to an elevation that could inundate the existing shoreline.

Water levels desired by wildlife interests conflict somewhat with those required to enhance the fishery and recreation. Stability of water levels are desirable in the spring to promote waterfowl nesting along the shoreline and on the islands. A reduction in water levels following the nesting season is also desirable as it would improve aquatic vegetation growth and thereby improve the quality of the area for waterfowl staging in the fall.

Generally, Manitoba Hydro's plans for Kiskitto Lake regulation will benefit resources and their uses in this area. However, to further enhance benefits accruing from the project, the following design alternatives for Kiskitto Lake regulation were considered.

ALTERNATIVE 1

The Manitoba Hydro design for Kiskitto Lake regulation could be modified to provide a stoplog structure in place of the proposed rock weir. This modification would require lowering of the weir crest approximately three feet to elevation 691.0 feet. Such a design modification would permit an annual drawdown one foot lower than originally proposed (Fig. 3) at an estimated increased cost of $100,000.

Increased opportunities for lake level manipulation, albeit limited, would enhance wildlife research and management capabilities. Benefits to fisheries and recreation would remain relatively unchanged.

ALTERNATIVE 2

The Manitoba Hydro plans for Kiskitto Lake regulation could be modified to provide a stoplog structure, as above, as well as significant increased channel excavation and improvement. The stoplog structure and increased channel improvement would provide for and accommodate a one foot increase in the maximum proposed lake level, significantly increased flows through the improved channel along Black Duck Creek, and a one foot lower drawdown in annual lake level than originally proposed by Manitoba Hydro. This modification would increase costs of Kiskitto Lake regulation by approximately $500,000 to $600,000[3]. Although wildlife benefits would be relatively the same as Alternative 1, additional benefits could be anticipated for the fishery.

It would be desirable to increase the flushing rate of Kiskitto Lake which would improve water quality and increase fish productivity. The gated culvert in the Kiskitto Lake dam could provide this flushing by allowing water to flow into Kiskitto Lake from the West Channel. The West Channel water would provide nutrients from the Nelson River, perhaps decrease the turbidity of Kiskitto Lake and increase dissolved oxygen concentrations, and, generally improve water quality and fish productivity of Kiskitto Lake.

Considerable channel improvement is required to accommodate increased outflows associated with increased flushing requirements. Channel improvement costs increase with the rate and duration of flushing. However, in view of the limited potential for fisheries development and the questionable improved productivity resulting from the increased flushing rates, the $500,000 to $600,000 increased capital expenditure was not deemed justified.

---

[3] *Cost estimates were made by Manitoba Hydro personnel.*

SUMMARY

1. The fixed weir for control of Kiskitto Lake levels will maintain the lake on average at a constantly higher level than has been experienced under natural conditions. The natural range of lake level fluctuation will be significantly reduced by Kiskitto Lake regulation.

2. Fisheries and recreation have indicated that the proposed lake level control will be generally beneficial to their particular interests. Wildlife participants prefer some lake level fluctuation on a seasonal basis.

3. To accommodate the above interests, it has been agreed that Manitoba Hydro should be requested to modify the design of the outlet control works on Black Duck Creek to permit increased and a more flexible lake level control.

4. Additional costs associated with design changes to the Kiskitto Lake outlet control works are justified on the basis of

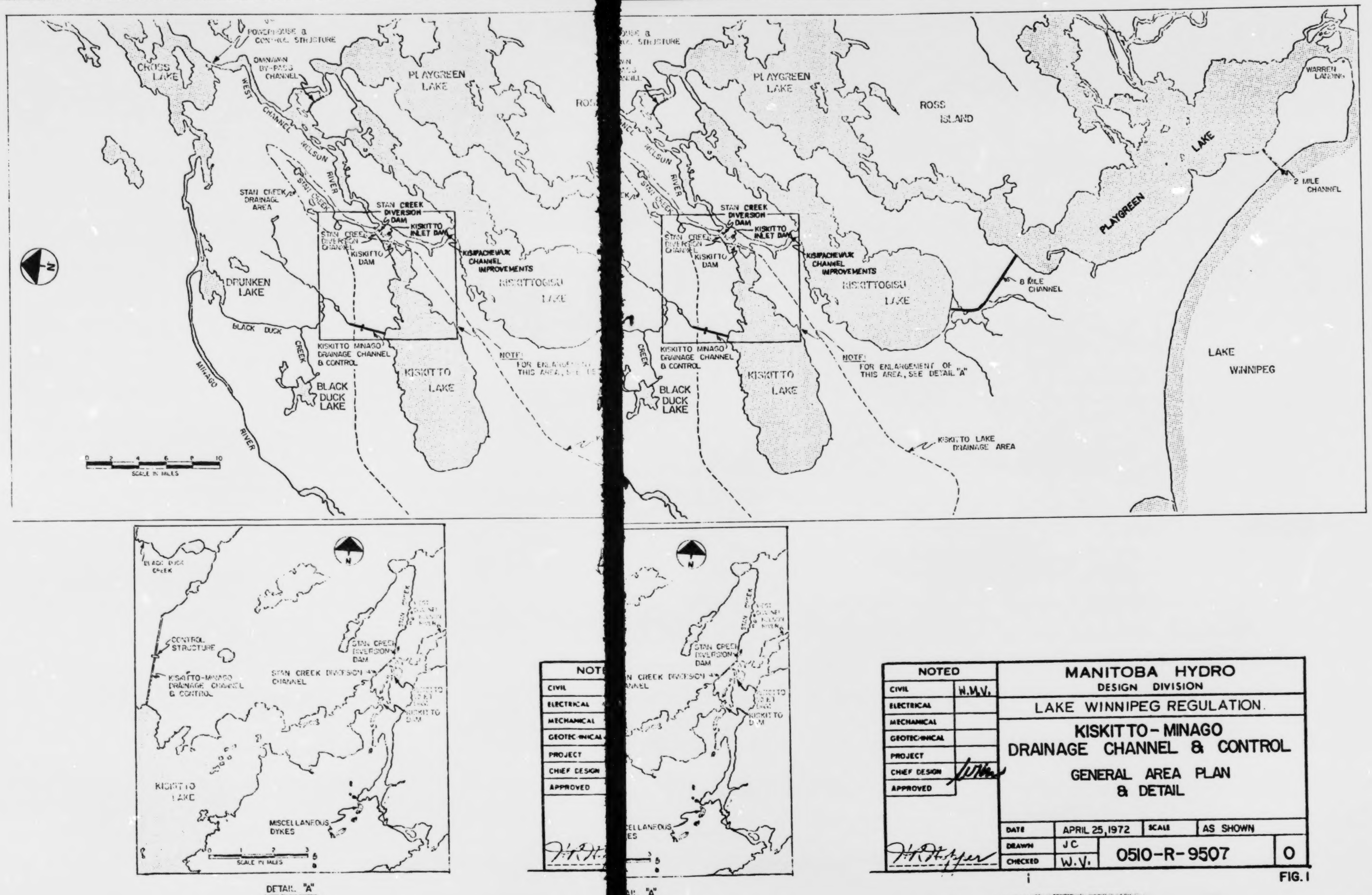
   (i) enhanced opportunities for wildlife populations, and

   (ii) increased experimental opportunities for future fisheries and wildlife research and management which results from flexibility in lake level regulation.

RECOMMENDATIONS

1. It is recommended that Manitoba Hydro be requested to modify the outlet control works design on Black Duck Creek to provide flexibility in lake level control.

2. Resource research and management agencies should be requested to further investigate the operational aspects of Kiskitto Lake regulation to determine optimum water levels for fish, wildlife and recreation resources.



DETAIL "A"

NOTED	
CIVIL	W.M.V.
ELECTRICAL	
MECHANICAL	
GEOTECHNICAL	
PROJECT	
CHIEF DESIGN	
APPROVED	

H.R. Hopper

MANITOBA HYDRO
DESIGN DIVISION

LAKE WINNIPEG REGULATION.

KISKITTO - MINAGO
DRAINAGE CHANNEL & CONTROL
GENERAL AREA PLAN
& DETAIL

DATE	APRIL 25, 1972	SCALE	AS SHOWN
DRAWN	J C	0510-R-9507	0
CHECKED	W.V.		

i

FIG. 1

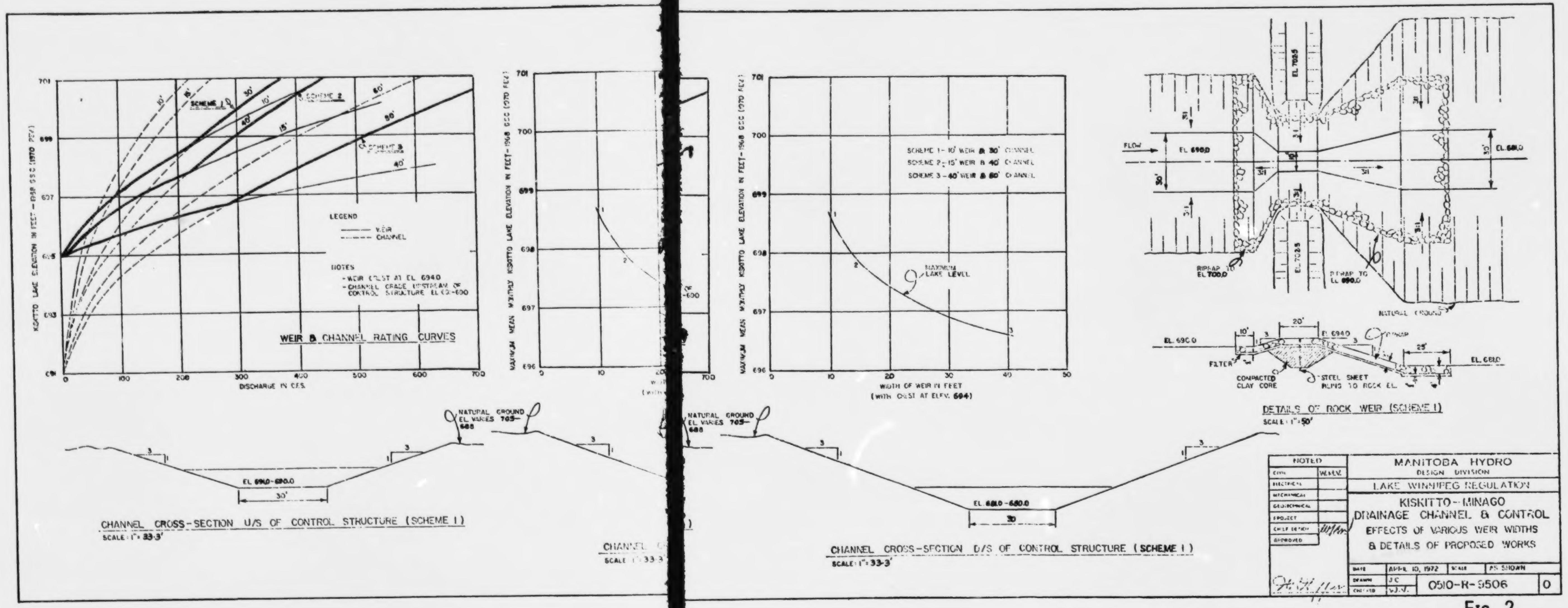
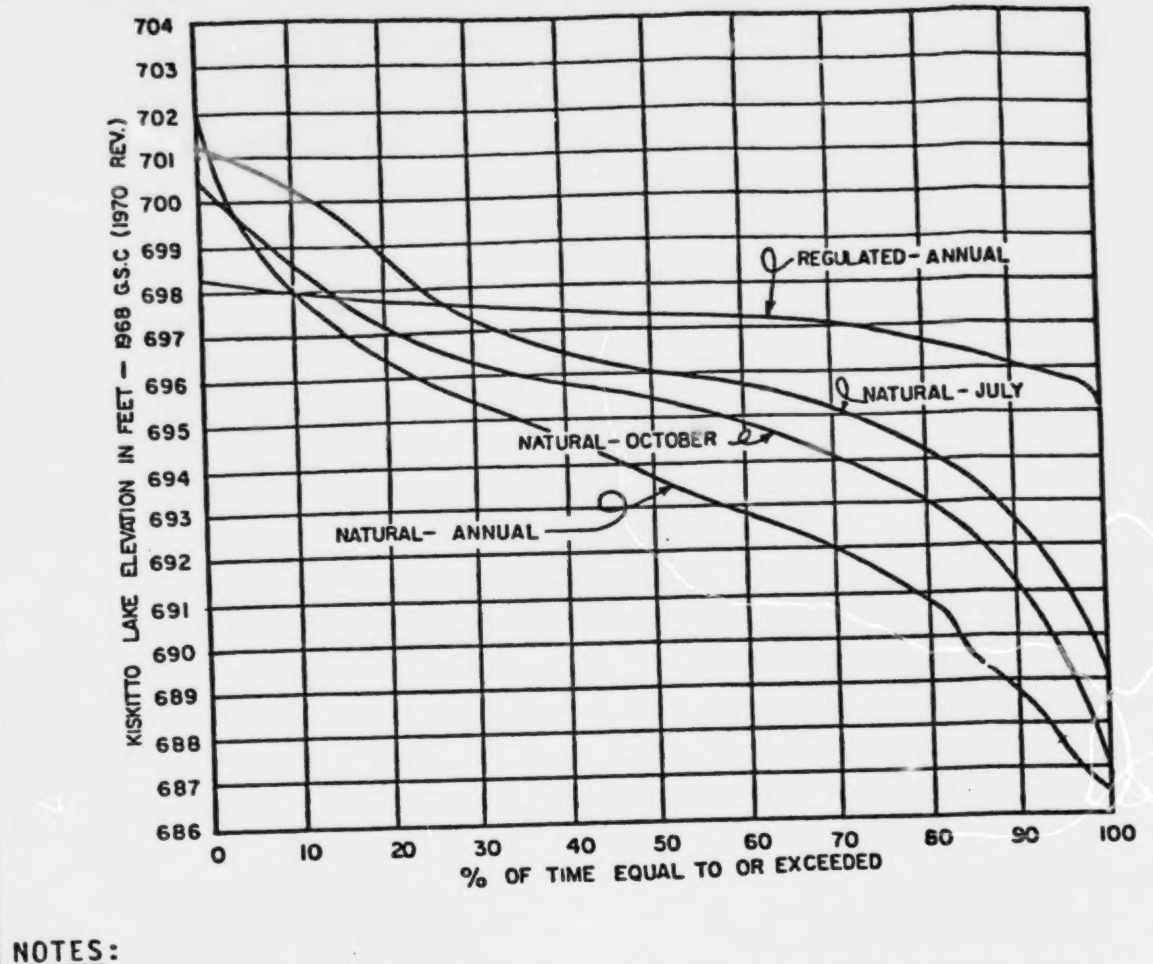

WEIR & CHANNEL RATING CURVES
KISKITTO LAKE ELEVATION IN FEET – 1968 G.S.C (1970 REV.)
DISCHARGE IN C.F.S.
SCHEME 1
SCHEME 2
SCHEME 3
10'
15'
30'
40'
60'
80'
LEGEND
WEIR
CHANNEL
NOTES
- WEIR CREST AT EL. 694.0
- CHANNEL GRADE UPSTREAM OF CONTROL STRUCTURE EL 691-690
MAXIMUM MEAN MONTHLY KISKITTO LAKE ELEVATION IN FEET – 1968 G.S.C (1970 REV.)
SCHEME 1 – 10' WEIR & 30' CHANNEL
SCHEME 2 – 15' WEIR & 40' CHANNEL
SCHEME 3 – 40' WEIR & 80' CHANNEL
MAXIMUM LAKE LEVEL
WIDTH OF WEIR IN FEET
(WITH CREST AT ELEV. 694)
FLOW
EL 690.0
EL 700.0
EL 702.5
EL 688.0
RIPRAP EL 700.0
RIPRAP TO EL 690.0
NATURAL GROUND
EL 690.0
EL 694.0
20'
25'
FILTER
COMPACTED CLAY CORE
STEEL SHEET PILING TO ROCK EL.
EL 688.0
DETAILS OF ROCK WEIR (SCHEME 1)
SCALE: 1" = 50'
NATURAL GROUND EL VARIES 705–688
EL 691.0–690.0
30'
CHANNEL CROSS-SECTION U/S OF CONTROL STRUCTURE (SCHEME 1)
SCALE: 1" = 33.3'
CHANNEL CROSS-SECTION D/S OF CONTROL STRUCTURE (SCHEME 1)
SCALE: 1" = 33.3'
EL 681.0–680.0
NOTED
CIVIL W.I.I.V.
ELECTRICAL
MECHANICAL
GEOTECHNICAL
PROJECT
CHIEF DESIGN
APPROVED
MANITOBA HYDRO
DESIGN DIVISION
LAKE WINNIPEG REGULATION
KISKITTO – MINAGO
DRAINAGE CHANNEL & CONTROL
EFFECTS OF VARIOUS WEIR WIDTHS
& DETAILS OF PROPOSED WORKS
DATE APRIL 10, 1972
SCALE AS SHOWN
DRAWN J.C.
CHECKED W.V.
0510-R-9506
0

FIG. 2.



NOTES:

1. BECAUSE WATER ELEVATIONS IN THE WEST CHANNEL OF THE NELSON RIVER ARE SUBJECT TO FLUCTUATIONS IN THE ORDER OF 5 FEET, DUE TO ICE JAMS, CALCULATED WATER LEVELS IN THE WINTER FOR KISKITTO LAKE ARE APPROXIMATE ONLY. THE DURATION CURVE FOR NATURAL CONDITIONS FOR ALL MONTHS IS BASED ON APPROXIMATED WINTER KISKITTO LEVELS ASSUMING ICE JAMMING IN THE WEST CHANNEL NELSON RIVER.
2. FULL SUPPLY LEVEL = 695 (CREST ELEVATION OF WEIR = 694).
3. REGULATED DURATION CURVES FOR JULY AND OCTOBER ARE ALMOST IDENTICAL TO REGULATED - ANNUAL

NOTED	
CIVIL	W.L.I.V.
ELECTRICAL	
MECHANICAL	
GEOTECHNICAL	
PROJECT	
CHIEF DESIGN	
APPROVED	

MANITOBA HYDRO
DESIGN DIVISION
LAKE WINNIPEG REGULATION
KISKITTO – MINAGO
DRAINAGE CHANNEL & CONTROL
NATURAL & REGULATED
DURATION CURVES
KISKITTO LAKE 1921-1970
10' WIDE CONTROL STRUCTURE

DATE	APRIL 20, 1972	SCALE	AS SHOWN
DRAWN	J.C.	0510-A-9504	0
CHECKED	W.V.		

FIG 3

APPENDIX 1 - N

GENERAL TIMBER CLEARING GUIDELINES

GENERAL TIMBER CLEARING GUIDELINES

by

D. H. DUNCAN
F. F. Slaney & Company Limited
Vancouver, British Columbia
October, 1973

CANADA - MANITOBA

LAKE WINNIPEG, CHURCHILL and
NELSON RIVERS STUDY BOARD

693 TAYLOR AVENUE WINNIPEG R3M 2K2

c/o Water Planning & Management Branch,
Department of the Environment,
OTTAWA, Ontario. K1A 0H3

October 31, 1973

The Honourable Jack Davis,
Minister, Environment Canada,
OTTAWA, Canada.

The Honourable Sidney Green, Q.C.,
Minister, Manitoba Department of Mines,
Resources and Environmental Management,
WINNIPEG, Manitoba.

Mr. L. A. Bateman, P. Eng.,
Chairman, Manitoba Hydro,
WINNIPEG, Manitoba.

Gentlemen:

The Lake Winnipeg, Churchill and Nelson Rivers Study Board has identified the need for guidelines for timber clearing within areas affected by Lake Winnipeg regulation and the Churchill-Burntwood diversion. General guidelines for timber clearing have been developed and are outlined in the attached report. Subsequent to completion of resource studies in each of the geographic areas covered by the Study, the Board will arrange to have specific recommendations on timber clearing prepared.

The Board has made Manitoba Hydro aware of these general timber clearing guidelines. Consequently, no further action is required at this time.

The Board recommends that the Ministers agree to release this report, "General Guidelines-Timber Clearing", to the public.

Yours truly,

N. H. James,
Chairman.

Enc.

b.c. Dr. I. W. Dickson

Mr. N. H. James,
Chairman,
Lake Winnipeg, Churchill and
Nelson Rivers Study Board,
c/o Water Planning & Management Branch,
Environment Canada,
9th Floor, Place Vincent Massey,
St. Joseph Boulevard,
HULL, Quebec.

Dear Mr. James:

At the request of the Board, a report titled "General Guidelines - Timber Clearing, 1973" has been prepared by Mr. Don Duncan, F. F. Slaney and Company Limited in conjunction with other participants of the Lake Winnipeg, Churchill and Nelson Rivers Study. This report has been modified in accordance with direction from the Board.

I would recommend that copies of this report be forwarded to the appropriate federal and provincial Ministers and to the Chairman, Manitoba Hydro.

Yours truly,

I. W. Dickson

I. W. Dickson,
STUDY DIRECTOR.

F. F. SLANEY & COMPANY LIMITED

RESOURCE DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT
Cable·SLANEYCO ▲ 402 W Pender Street ▲ Vancouver 3 Canada ▲ Phone 682·6308

January 17, 1973
File: M23

Dr. Ian Dickson, Study Director,
Lake Winnipeg, Churchill and
Nelson Rivers Study Board,
693 Taylor Building,
Pembia Avenue,
Winnipeg R3M 2K2, Manitoba.

Dear Dr. Dickson,

The attached report provides general guidelines for evolving a clearing program. Advice obtained from interviews with other members of the study group was combined with data from previous studies to formulate these preliminary concepts.

Studies of archaeology, forestry, recreation and to a lesser extent fisheries provided new and relevant data for the clearing study.

Unfortunately some of the most relevant studies, soils and terrain, were not processed in a form that could be utilized and as a consequence this report contains many precepts that are founded on past experience in other reservoirs.

The lack of firm data on the extent of the potentially unstable terrain in the study area is a serious deficit of this preliminary report.

We look forward to evolving these concepts further.

Yours very truly,
F.F. SLANEY & COMPANY LIMITED

D H Duncan

D.H.Duncan, P.Ag.,

DHD/brf.

Enclosure:

▲ FORESTRY ▲ AGROLOGY ▲ FISH AND WILDLIFE ▲ RECREATION ▲ ENGINEERING ▲

GENERAL GUIDELINES
TIMBER CLEARING

SOUTHERN INDIAN LAKE
RAT-NOTIGI DRAINAGE

BURNTWOOD RIVER
OUTLET LAKES

LAKE WINNIPEG, CHURCHILL AND
NELSON RIVERS STUDY BOARD

JANUARY, 1973

F.F. SLANEY & COMPANY LIMITED
VANCOUVER, CANADA

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PART I

CLEARING GUIDELINES: SOUTHERN INDIAN LAKE RESERVOIR

1.1 THE PROJECT

The program presented for clearing the estimated 90,000 acres of forested lands that would be inundated by raising Southern Indian Lake to elevation 850 feet is preliminary and subject to refinement as data are collected and assimilated.

1.2 FACTORS CONSIDERED

1. The people at South Indian Lake will be required to make major social adjustments because of proposed road access, increased industrialization of the region and disruption of historic fishing patterns regardless of the extent and type of clearing.

2. Leaf Rapids is a bold experiment in developing a viable frontier mining town where the residents are to be self-governing and encouraged to develop all the resources of the region. The opportunity should not be overlooked to employ a nuclei of local residents for long term development of the reservoir. Again, the type and extent of clearing will directly affect the potential for utilizing many resources of Southern Indian Lake.

3. Debris from flooded timber lands would increase the physical difficulties in the commercial harvesting of whitefish for an indefinite period.

4. The proposed 10 to 12 foot rise in water levels creates a situation where almost all the lands to be inundated will be under the active influence of wave action and will, over time, erode to form a new shoreline. This process coupled with high ice content soils will tend to undermine flooded trees that are left or expose stumps of felled trees leaving a littered shoreline.

5. Schultz (1968)[1] reported that the removal of merchantable* timber from the proposed reservoir site was not economically feasible and, if charred, would assuredly be rendered useless for commercial purposes.

6. The coniferous forests of the region often present a high fire risk during the spring and summer. Large-scale clearing by burning would be hazardous to the vast stands of forest immediately behind the fringe of timber affected by the extended reservoir.

7. Wind is the prime factor in the movement and compaction of floating debris. Control of floating debris is primarily a function of opportunity. To maintain navigation routes through narrows, tugs with boomsticks are required to confine masses of debris when the material is driven into a secure bay. Towing masses of debris in a lake as large as Southern Indian would be pointless. Water currents in the lake are not expected to cause noticeable movement of floatage.

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[1] *C. D. Schultz & Company Limited. 1968. A Preliminary Investigation into Timber Harvesting and Land Clearing in Southern Indian Lake Reservoir.*

* *merchantable - refers to trees having a diameter of 4 inches or greater and a height of 30 feet or more.*

8. Shoreline stabilization is a function of reach, water depth, water regime, exposure, slope, soil type, ice content, vegetative cover and treatment of cover. Firm data particularly on soil types, ice content, and slopes are required before a clearing program can be designed to create both short term and long term benefits.

9. The extensive flat sandy or gravelly beaches in the northern portion of the reservoir site would remain relatively stable after flooding.

10. Migration, spawning and rearing areas for fish and the relationship of wildlife to the habitat to be inundated is not properly understood at this date.

11. The flooded timber would be standing in 10 feet or less of water and consequently is highly visible and easily accessible.

12. Social pressures to clear Southern Indian Lake for aesthetic reasons are great and if funds are spent primarily for grooming purposes the chances of having funds available for mitigation or improvement of ecological conditions are considerably reduced.

13. A crash program for a large scale clearing operation could create social and economic havoc in the region.

14. Values of the resources affected by the proposed raising of Southern Indian Lake have not yet been fully defined. Capital spent in possible low priority clearing operations may be lost capital for the further development or enhancement of other regions.

15. An annuity designated for expenditures to enhance the environment of the reservoir site would resolve long-range fiscal problems.

16. Permanent employment for a nucleus of local people helps to stabilize a community. The proposed reservoir cleanup work affords a variety of both land and water based activities that traditionally are attractive to Indian workers.

17. The fringe of timber flooded by raising the level of the lake by 10 feet would not interfere appreciably with normal use of the existing lake area by fishermen or travellers. The aesthetics of the strip of flood-killed timber would be the primary affront to users.

18. Clearing fire-killed timber from rocky shorelines could accelerate the development of potential spawning sites for whitefish.

1.3 TENTATIVE CLEARING GUIDELINES

1.3.1 GENERAL

At this stage of development of northern Manitoba, and more particularly Southern Indian Lake, the rationale to select particular segments of the lake for immediate clearing and to relegate other areas such as remote bays for no treatment can be easily presented.

However, the impulse to start a massive cleanup of timber to be flooded for primarily cosmetic purposes may defeat what should be the ultimate objective, that is, clearing the entire system at a price compatible with benefits accrued. The time scale for cleanup could span several generations.

The basic promise of the proposed clearing guidelines is to undertake only the most advantageous aspects of clearing in the immediate future and to budget adequate funds to carry on a continuous program of clearing, cleanup and mitigation. Operating revenues could sustain an effective cleaning program indefinitely.

1.3.2 SUGGESTED SITES FOR CLEARING IN ORDER OF PRIORITY

1. Hand clear (pile and burn) identified archaeological sites according to priorities and specifications of the archaeologists.

2. Hand and machine clear all foreshore areas of identified recreational or park sites designated within about 20 miles of Leaf Rapids.

3. Clear (pile and burn) all fire-killed stands to elevation 852 feet within about 20 miles of South Indian Lake Village and the town of Leaf Rapids.

4. Hand clear (pile and burn) all woody material over one inch in diameter or four feet tall to elevation 852 feet within about 10 miles of South Indian Lake Village. (Operate during periods of minimum fire hazard).

5. Clear, as above, for all lands to elevation 852 or 50 feet horizontally from elevation 850, whichever includes the least area, from Leaf Rapids to Opachuanau Lake.

6. Clear for mitigation purposes, sites identified by biologists for special significance to fish or wildlife.

7. In accordance with wildlife interests, clear selected sites above elevation 850 feet for replacement of riparian vegetation with more preferred wildlife habitat.

8. Circumstances will alter cases and clearing priorities should be re-assessed before embarking on a post flooding clearing and cleanup operation. Use of both water-based equipment and complementary units operating over the ice is envisaged.

PART 2

CLEARING GUIDELINES: RAT-NOTIGI RESERVOIR

2.1 THE PROJECT

An estimated 86,000 acres are to be flooded in the Rat-Notigi system. The maze of lakes, bays, arms, channels and rivers form a narrowly connected waterway even at full pond elevations.

2.2 FACTORS CONSIDERED

1. The proposed reservoir site is characterized by small lakes connected by narrow channels. The practicability of maintaining a safe passageway through the system is remote until an extensive clearing program is completed.

2. The proposed road from Leaf Rapids to South Indian Lake Village will provide fast, safe and dependable year round access for local people travelling in or out of South Indian Lake Village.

3. The presence of silts and clays with a high ice content suggests that specific areas of the inundated soils could become almost fluid and would, as a consequence, release trees or stumps to form masses of floating debris.

4. The potential value of the proposed reservoir as a commercial fishery resource is unknown.

5. The system of lakes lends itself to clearing portions of the reservoir with a minimum danger of floatage drifting from other areas.

6. Recreational use is readily manipulated by providing access to and facilities in areas where immediate use is desirable and by limiting access and facilities where tourist activities are to be discouraged.

7. Present day tourists to the Rat River system have a multitude of alternatives for water-based recreation. Granville Lake is the most obvious. South Indian Lake Village and South Bay are other tourist attractions.

8. The effect of flooded trees on the water quality in northern reservoirs is minimal.

9. The technology of timber handling equipment is in a period of rapid advancement. The possibility of obtaining advanced mechanical units to remove flooded timber increases annually.

10. Technology exists to pile floating or flooded timber directly onto a fire and keep the machine operating at maximum capacity.

11. Barge-mounted burners fed by grapple equipped cranes would be a practical method of disposing of floatage anywhere in the system. Barge-mounted accommodation for crews would also be required.

12. The Forebay area at Notigi and the proposed diversion channel to Issett Lake should be cleared for hydrological reasons.

13. Aircraft could operate from the larger water bodies within the reservoir system to provide access to the entire system.

14. Winter use of the system would not be hampered appreciably by debris frozen in the ice or by the indicated drawdown.

15. Wildlife studies of the proposed reservoir site are incomplete and firm data on possible mitigation sites are not available. Clearing to encourage riparian growth is generally desirable, and clearing the fringe of small islands may be advantageous to birds and as calving grounds for ungulates.

16. Vegetative cover in sites below the littoral zone would remain stable indefinitely, particularly if stems were sheared at ground level.

17. A commercial fishery based on fish traps rather than gill nets should be considered for some of the narrows, and in particular the dredged channel.

18. Disposal of woody material by chipping and leaving the residue to either sink or accumulate on the shore could be beneficial in sites where soil stability is poor, but may raise B.O.D.

2.3 TENTATIVE CLEARING GUIDELINES

2.3.1 GENERAL

The development of the Rat-Notigi waterway as a safe route from Notigi to South Indian Lake Village would involve a major clearing project with only minor identifiable benefits to fish and wildlife.

2.3.2 SUGGESTED SITES FOR CLEARING IN ORDER OF PRIORITY

1. Hand and machine clear (pile and burn) the forebay at the Notigi dam site.

2. Hand clear archaeological sites according to requirements of the professional archaeologists.

3. Clear shorelines of campsites in the Notigi forebay area under the guidance of parks personnel.

4. Extend clearing to include Notigi Lake and environs to a radius of some 10 miles from the dam site.

5. Set up experimental clear[illegible] of about 10 acres each to ascertain the character[illegible] development of the littoral zone over a wide base of soil types, slopes, aspects, water regimes, vegetative cover types and manipulations of forest cover. Monitor both experimental and control sites to obtain firm data on the interactions of the elements involved in the process of normalizing the shoreline.

6. Fell and manufacture into boomsticks the larger white spruce adjacent to the main waterway.

7. Clear the channel with machines from South Bay to Issett Lake to provide easy access to the lake. Clean up the shoreline of Issett Lake.

8. Fell trees over two inches in diameter rooted below elevation 840 feet along the narrow connecting channels on the route from Notigi to South Bay. Leave the trees to float. Trees of two inches or less diameter will be almost totally inundated and would offer little, if any, impediment to boat traffic.

9. Clear specific sites for mitigation purposes if and as identified by fisheries or wildlife research teams.

10. Embark on a long term program to clean up and maintain the entire reservoir system according to future needs.

11. Research to evolve and improve techniques to cut firmly rooted trees underwater and to remove trees with roots from the active littoral zones should be a priority project. It is anticipated that wave action accompanying fluctuating water levels will cause soil and shoreline degradation such as to expose tree stumps and roots along newly established shorelines. Permanently inundated stumps and roots would not affect shoreline features.

PART 3

BURNTWOOD RIVER

3.1 THE PROJECT

The Burntwood River will be required to accommodate the additional flow from diverting 30,000 c.f.s. from the Churchill System. The timing, amount and the effect of this increased flow on the stability of the forested banks are not documented at this date.

3.2 FACTORS CONSIDERED

1. Clearing shrub cover from the river bank would increase the potential for slippage.

2. The selective cutting of large trees along shorelines influenced by fluctuating water levels will retard bank erosion and may present further collapse of small and concentrated water soaked timber stands. Tree stems should be piled and burned.

3. Selected accessible sites where the Burntwood River widens or flows through a lake could be utilized to trap floatage in booms and to pile out and burn debris using cranes.

4. Special attention to bridge structures will be required during initial peaks to control possible accumulation of debris.

5. The portion of the diversion system immediately below the Notigi dam site has high recreational potential and clearing in this area should extend to Wapisu Lake.

6. A system of diversion booms with boat gaps designed to control potential floatage at several points would prevent the accumulation of unmanageable masses of material.

7. Firm data on peak flows, terrain sensitivity, forest cover and structures are not available.

8. The effect of increased flows on ice movements is an unknown which requires further analysis.

3.3 TENTATIVE CLEARING GUIDELINES

1. Selectively clear the section of the diversion channel from Notigi dam to Wapisu River to and including Wapisu Lake. Clear only the coniferous and deciduous trees that are less tolerant of flooding. Riparian types of vegetation more tolerant of flooding such as willows and cottonwood should be left standing in order to enhance soil stability and provide suitable wildlife habitat. The clearing boundary should be about two feet above projected summer high water flow.

2. Buck trees currently within the river channel into about 8 foot lengths to reduce the hazard of log jams during the initial rise.

3. Define areas of forested lands where slippage is anticipated and special clearing procedures will be required.

4. Locate boom sites, establish tail holds, design boom structures, collect boom sticks and have booms in readiness for coupling when needed.

5. In anticipation of future shoreline degradation and associated fallen timber, utilize crews operating from river boats to fell, buck and burn all trees over 6 inches D.B.H. currently being undermined or leaning towards the river channel.

6. Locate and construct sites where crane and grapple operations could pile out and burn floatage collected by booms.

PART 4

OUTLET LAKES

4.1 THE PROJECT

The proposed Jenpeg hydro dam in the west channel of the Nelson River would raise the level of the west channel and flood lands to elevation 715 feet. Most of the lands are forested. The full extent of the flood basin is not as yet defined.

Dredge spoil from dredging of the 8 mile channel connecting Playgreen Lake with Kiskittogisu Lake is spreading over forest lands and clearing may be beneficial.

A program to salvage timber and to clear the forebay area in the west channel is underway. An estimated 97,000 cunits of softwood and 18,000 cunits of hardwood are considered merchantable and accessible by the Department of Mines, Resources and Environmental Management.

4.2 FACTORS CONSIDERED

1. The logging and clearing specifications for the Jenpeg forebay should be realistic based on a study of maps, photographs, clearing documents and conferences with other members of the Study group.

2. Implementation of the proposed clearing program and the nature of field operations are the prime factors to be analyzed at this date.

3. Potential use of Jenpeg forebay area for recreation has been identified and clearing should be designed primarily to serve this purpose.

4. Bulldozers with shearing blades could cut all trees flush with the ground in a single pass.

5. Felling with chain saws, particularly on flat ground, tends to leave stumps which become a particular nuisance to boaters in shallows.

6. The use of large flails is a useful way to eliminate brush and small timber. On previously logged lands, the larger stumps would not be destroyed by this procedure.

7. Where possible, areas supporting pine should be cleared during summer months using conventional bulldozers and clearing blades. Trees and roots are normally piled and burned for the same cost as removing tops only. This procedure usually provides a better shore for recreational use than hand felling.

8. Floating debris would drift down the west channel and accumulate in the narrowing neck that fronts the dam site.

9. No areas of particular archaeological interest have been identified by investigating archaeologists.

10. Boat launching sites should be designed specifically for water levels anticipated during the tourist season. Wide strips of groomed beach along the shoreline provide more effective landing sites than narrow strips extending the width of the drawdown.

11. The feasibility of windrowing timber adjacent to the dredge channels to limit the spread of spoil should be investigated.

12. Coniferous trees will die from having their roots in a layer of silts or clays. Willows would not be affected.

13. Boat gaps should be incorporated into standing booms used to control floatage.

14. No comprehensive data on soils, terrain stability, wildlife or fish are available for these specific sites at this date.

4.3 TENTATIVE CLEARING GUIDELINES

1. The Study Board should establish a means of communication with clearing and logging operations. As data are compiled and problems identified, clearing practices could be modified within the framework of the total budget.

2. The extent of the proposed flooding is not fully known at this date and surveys should be conducted to ascertain the limits of flooding.

3. Special requirements of fish and wildlife must be further delineated before meaningful refinements of the clearing program could be formulated.

4. The feasibility of working in close alliance with the organizations directly responsible for the clearing should be investigated with the object of obtaining maximum benefit from findings of the Study.

5. Clearing boundaries should be extended in areas with particular mitigation potential as identified by wildlife investigators. Clearing strips on islands may benefit nesting waterfowl.

PART 5

IMPLICATIONS OF CLEARING SOUTHERN INDIAN LAKE

BASIC CLEARING OPTIONS

ELEMENTS OF INTERACTION	No Clearing	Disposal of cover prior to flooding	Fell - Float and remove floatage	Clear designated sites for specific purposes	Mulch down forest cover with a flail	Grub and burn roots and tops
Terrain and Soil Rock Sands, Gravels Silts, Clays Organic Soils Ground Ice	Littoral development slowed. Debris would remain for decades.	Generally beneficial except that roots and stumps would eventually be exposed on most shores.	Slower initial development of shore. In long term stumps and roots would become exposed along littoral zone.	Manipulation of cover could retard or accelerate development of beaches.	As for fell and float procedure.	Recommended procedure where immediate development of a shore is desirable.
Vegetation Merchantable Timber Non-commercial Stands Riparian Brush Recent Brush Marsh Lands	No significant value in merchantable timber lost.	Chance to salvage some merchantable timber, particularly boomsticks.	Best chance to recover merchantable material.	Clearing could extend beyond reservoir boundary to induce the regrowth of riparian vegetation.	Probably the most economical method of removing light forest cover. Chance to operate over ice and frozen ground.	Recommended clearing procedure for gravelly sites where bulldozers can operate on unfrozen soil.
Wildlife Ungulates Waterfowl Furbearers Upland Game Birds	Dead standing trees over water are attractive to many animals. Potential hazard to large animals swimming.	Some minor benefits. Fire hazard to adjacent habitat.	Floatage a possible hazard to large animals swimming.	Clear small islands and spits for waterfowl nesting and resting habitat.	No particular advantages to wildlife except that small mammals may utilize mounds of drift.	Possible adverse effects on fringe vegetation. Chance to establish grass or forbes.
Fish Spawning Migration Feeding B.O.D.	No adverse effects expected. Development of new spawning areas retarded.	No significant effects.	Minimum impact on fish stocks expected.	Rocky or gravelly sites could be cleared to provide new spawning beds. Creek mouth cleared.	Maximum B.O.D. created. Sunken chunks of debris may damage spawning sites.	Method of developing gravel and rocky sites for spawners.
Archaeological Sites Identification Preservation Excavation	No effect.	Would facilitate excavation of site. Broadcast burn would cause no damage.	Minor effect. Some site indicators lost. No significant disturbance of site.	Immediate opportunity to hand clear and burn identified archaeological sites to facilitate excavation.	Minimum effect.	Grubbing would destroy the contextual integrity of the sites.
Recreation Campsites Boat Launching Sites Access Safety	All aspects would be adversely affected.	Recommended procedure for recreation benefit.	Short term effect adverse. Medium term effect beneficial. Long term effect as for complete clearing.	Efficient use of funds according to need. Limits full use of reservoir.	Economical and fire safe method of eliminating forest cover. Small chunks not hazardous to boats.	Recommended for select gravel beds and boat launching sites. Unnecessary on most sites.
Socio-economic Trapping Fishing Boating Aesthetic	Aesthetically unattractive. Maximum adverse impact on human use of reservoir.	Minimum disturbance of existing usage. Improved access. Costly.	Floatage hazardous to small boats. Blockages of inlets and narrows may occur.	Passageway and harbours could be cleared. Prime fishing areas could be maintained.	Floatage would present no serious hazard to boats except to slow passage. Access could be maintained.	Grubbing flat ground reduces hazard of stumps to boat traffic. Extreme sedimentation of water expected in short term.
Hydroelectric Water Regime Intake Screens Spillway Structures	Long term maintenance required. Intake and control structures affected by debris.	Minimum maintenance of structures required. Maximum access with the reservoir. High capital expenditure.	Short period of maintenance. Control of floatage a major operating cost.	Forebays cleared and boomed to keep floatage clear of structures.	Mulched material could be a problem on intake screens.	No particular advantage, except to remove potentially unstable stumps from forebay area.

PART 6

IMPLICATIONS OF CLEARING THE RAT-NOTIGI DRAINAGE

BASIC CLEARING OPTIONS

ELEMENTS OF INTERACTION	No clearing	Disposal of forest cover prior to flooding	Fell – Float and remove floatage	Clear designated sites for specific purposes	Mulch down forest cover with a flail	Grub and burn roots and tops
Terrain and Soils Rock Sands, Gravels Silts, Clays Organic Soils Ground Ice	Wave action will affect a fringe of the land inundated. Completely submerged vegetation will remain in place indefinitely.	Recommended clearing procedure for flat lands with silt, clay or organic soils. Shearing the vegetation off at the root collar would leave a mat to stabilize soil with high ice content.	Less disturbance to vegetative mat if no burning occurs. Soils undisturbed.	Removing the forest cover from areas of bedrock or gravel would accelerate stabilization of shoreline.	Blanket of wood chunks along shoreline could reduce rate of erosion.	Not recommended except on gravelly sites as initial turbidity would likely increase.
Vegetation Merchantable Timber Non-commercial Cover Riparian Brush Recent Burns Marsh Land	The loss of merchantable timber is not a major consideration.	Procedure probably unwarranted for stands of small timber which does not extend beyond minimum drawdown level.	Economical method of removing forest cover where broadcast burning is difficult or dangerous.	The few large white spruce should be salvaged for boomsticks where possible.	Economical method of removing brush and stunted trees. Broadcast burns could remove excessive accumulations.	No advantages except where recreational demands require a stump-free foreshore or backshore.
Wildlife Ungulates Waterfowl Furbearers Upland Game Birds	Windfall from flood-killed timber could be a hazard to swimming ungulates. Other wildlife would be little affected by leaving flood-killed stands.	Clearing would provide little advantage to wildlife unless areas were cleared beyond elevation 850 feet to promote riparian growth.	Free moving floatage would be a hazard to large animals in the water.	Clearing flats beyond the flood line could create riparian habitats. Clear small islands for waterfowl nesting sites.	A fringe of driftwood would offer a diverse habitat to small mammals.	No identified advantage to wildlife.
Fish Spawning Migration Feeding B.O.D.	Probably most detrimental to whitefish and lake trout. Other species not adversely affected.	Questionable value for fish habitat improvement.	Large masses of floating logs appear to attract schools of fish and may in fact provide additional food and protection.	Clearing timber from rocky sites between elevation 835 and 850 feet may provide alternate spawning sites for whitefish.	Possible hazard to fish.	The development of potential spawning sites on coarse gravel beaches would commence with grubbing.
Archaeological Sites Identification Preservation Excavation	No effect.	Sites should be marked and reserved for hand clearing only.	No effect.	Known archaeological sites should be cleared where excavation is contemplated.	Minimum disturbance.	Maximum disturbance.
Recreation Campsites Boat Launching Access Safety	Reservoir site would be unattractive and dangerous to boaters into the distant future.	Acceptable site for recreational use.	Hazardous to boating over the short term. Crane piling and burning operations could dispose of floatage.	Clearing of campsites, boat launching sites and harbours could satisfy immediate needs.	Similar to floating logs except less chance of becoming trapped in shifting debris.	Campsite areas and the immediate forebay areas should be grubbed. If not stumps might work free.
Socio-Economic Trapping Fishing Access Aesthetics	Maximum cost to local residents. Hazardous waterway. Socially unacceptable.	Costly. Beneficial to locals. Crash programs are unduly expensive and socially disruptive.	Short term disadvantage compared to pre-flooding cleanup. Final results acceptable over the long term.	Access route to Southern Indian Lake could be cleared. Large bays could be boomed off.	Possible effect on long term commercial fishery difficult to assess.	Not significant.
Hydroelectric Water Regime Intake Screen Spilling	Continuous maintenance required.	Excessive capital cost for direct benefits attributable to clearing.	Reasonable capital outlay. Flexible program for cleanup feasible.	Forebays should be cleared and boomed off.	Maximum impact on intake screens at Notigi.	Not significant.

APPENDIX 1 - O

TIMBER CLEARING IMPLICATIONS
WITH EMPHASIS ON THE
WEST CHANNEL OF THE NELSON RIVER,
KISKITTOGISU LAKE, AND 8-MILE AND 2-MILE CHANNELS

TIMBER CLEARING IMPLICATIONS WITH EMPHASIS ON THE WEST CHANNEL OF THE NELSON RIVER, KISKITTOGISU LAKE, AND EIGHT-MILE AND TWO-MILE CHANNELS

by

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Winnipeg, Manitoba
November, 1973

for

THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

SPECIAL NOTE

THE CONCLUSIONS AND RECOMMENDATIONS CONTAINED IN THIS APPENDIX ARE THOSE OF THE AUTHOR(S) AND ARE NOT NECESSARILY THE SAME AS THE CONCLUSIONS AND RECOMMENDATIONS OF THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD AS EXPRESSED IN THE SUMMARY REPORT AND THE TECHNICAL REPORT.

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INTRODUCTION

In accordance with the Terms of Reference for the Lake Winnipeg, Churchill and Nelson Rivers Study, Study participants have evaluated timber clearing as a measure for mitigating effects of flooded timber. This report briefly summarizes their views as outlined in reports and meetings. It describes the effects of flooded timber, assesses the current Manitoba Hydro timber clearing program and recommends future timber clearing requirements and associated studies.

Lake Winnipeg regulation involves increasing the outlet capacity of Lake Winnipeg, and the installation of a control structure at Jenpeg on the West Channel of the Nelson River. Lake Winnipeg regulation is likely to cause flooding in three areas (see attached Outlet Lakes Map):

(1) the West Channel of the Nelson River between the Jenpeg site and Kisipachewuk Rapids;

(2) areas bordering Kiskittogisu Lake; and

(3) the dredge spoil sites at Two-Mile and Eight-Mile channels.

The impact of Lake Winnipeg regulation on each of these areas has been examined to:

(1) identify the impacts of inundated timber,

(2) examine timber clearing as a mitigation measure,

(3) outline options for furtherance of timber clearing, and

(4) propose recommendations for timber clearing in the Outlet Lakes Area.

Regulation will alter the pattern of water levels on Lake Winnipeg, Playgreen Lake, Kiskittogisu Lake, and the West Channel of the Nelson River. Impacts due to flooding of timbered areas will be significant in areas along the West Channel of the Nelson River between Jenpeg and Kisipachewuk Rapids, and Kiskittogisu Lake. Dredge spoil deposition in timbered areas will occur in the vicinity of the Two- and Eight-Mile channels.

THE WEST CHANNEL OF THE NELSON RIVER

Manitoba Hydro has contour mapped that area of the West Channel between Jenpeg and Kisipachewuk Rapids at one-foot contour intervals. They have designated the 715-foot elevation contour as the boundary of inundation with regulation. While the designated 715-foot elevation contour does not allow an extensive freeboard for additional impacts associated with wave and ice action, for the purposes of this report, the impact area along the West Channel of the Nelson River is designated by the 715-foot elevation contour.

The shoreline of the West Channel of the Nelson River is typically bedrock controlled and is generally lined with outcropping bedrock. The outcroppings are wide, low and smoothly glaciated. The overburden is thin along most of the backshore. Drainage is generally good throughout this profile; however, permafrost may be found where organic layers provide insulation.

IMPACTS

(a) VEGETATION

Based on the 715-foot elevation contour, 21,821 acres[1] of existing land surface will be inundated in this portion of the West Channel. Typical treed-muskeg vegetation covers 9,105 acres, 11,723 acres are timber covered, and 937 acres have no forest cover.

Riparian vegetation and most taller deciduous timber will survive unless the plant is completely inundated. Conifers are less tolerant of flooding and most will die over a period of two or three years. During this time, flooded vegetation would form a protective cover until various aquatic vegetation become established. Disturbance from wave action and subsequent erosion of the shoreline would thus be reduced or stabilized.

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[1] *Lamont, R. H. and Kaye, M., "Forest Resources Outlet Lakes Area", February 1973, Table IV, pp. 20-21.*

After flooding, the majority of debris in the West Channel is anticipated to be from fallen, broken, or burnt trees presently lying on the forest floor, and from broken branches from standing trees. The greatest debris problems are anticipated to occur in the early years after flooding as floating debris of this type generally sinks within ten years.

(b) FISHERIES

The existence of emergent timber will probably have little overall long-term impact on fish productivity, although northern pike should benefit from such inundation. However, the exploitation of fish for sport and commercial purposes will be made more difficult by emergent timber and the accumulation of debris associated with it. Currently, the West Channel is not commercially fished, and the development of a fishery in the future is uncertain. However, increased sport fishing activities are anticipated in this area.

Permanent road access and the viewing option associated with hydroelectric installation should promote sport fishing activity. In addition, Jenpeg may serve as a departure point for fishing trips up the West Channel to Kiskittogisu Lake and beyond. Lures will snag on emerged timber, and this would form a source of annoyance to fishermen in these areas.

(c) FORESTRY

The 21,821 acres that will be flooded along the West Channel are Provincial Crown Lands under lease to Churchill Forest Industries and Marine Transport Limited. Softwoods, such as jack pine, white spruce, black spruce, and balsam fir, cover 9,041 acres of the area to be flooded, and hardwoods cover another 2,682 acres. Treed muskeg, willow and alder, and protection forest cover 9,105 acres of the area to be inundated. It is estimated that the area to be flooded contains 111,710 cunits (100's of cubic feet) of gross merchantable[2] softwood and 47,980 cunits of gross merchantable hardwood.

There are currently no logging operations in the area, and future harvesting developments are uncertain.

(d) NAVIGATION

Flooded timber could act as natural channel markers; however, standing timber which lies just below the surface could be hazardous. In the West Channel the hazard created by submerged timber is anticipated to be minimal. No commercial traffic is presently using the West Channel and future utilization is based on the assumption that no alternate or more economical means of importing bulk commodities will be developed. Also, a barge operation which uses the West Channel will be faced with the problem of trans-shipment at the Jenpeg control structure. The additional costs associated with this handling could make such an operation uneconomical.

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[2] *Gross Merchantable Volume - This is the volume of all species with diameters 3.6 inches dbh (diameter at breast height) and larger and is found to a specified top diameter and a stump height of one foot. For spruce and pine, top diameter is 3 inches; for all other species, it is 4 inches.*

Emergent timber, submerged vegetation and the associated accumulation of debris will form a barrier to shoreline access for recreationists. The West Channel is not presently being used for recreational purposes; however it is anticipated that growing demand for outdoor recreation combined with the development of permanent road access, may lead to low intensity use of this area in the future.

(e) ARCHAEOLOGY

Preliminary investigations of the West Channel indicate that this area has relatively low archaeological value and therefore clearing is of little concern to the archaeological community.

(f) WILDLIFE

Emergent timber and the accumulation of floating debris along shorelines could have a detrimental effect on large animals that attempt to swim through tangles of debris. The extent of this potential problem has not been identified.

The flooded stands of timber could have a positive effect on the provision of viable habitats to most small aquatic animals and waterfowl.

(g) RECREATION

The West Channel is not presently being used for recreational purposes; however it is anticipated that growing demand for outdoor recreation combined with the development of permanent road access, may lead to low intensity use of this area in the future.

Emergent timber will have a negative impact on recreational use of the West Channel by presenting a hazard to reservoir boaters by blocking shoreline access, decreasing the aesthetic quality of the area, and causing damage to and loss of sport fishing equipment.

Benefits of flooded timber may include the development of niches and platforms for hunters.

(h) EMPLOYMENT AND TRAINING OPPORTUNITIES

Generally a pre-flood clearing program and a post-flood clearing program will provide opportunities for employment of resources that are currently unemployed, and a training program for unskilled labour. A pre-flood clearing program will usually provide more jobs than a post-flood clearing program but over a shorter period of time. Training opportunities will normally include bulldozer operation and chain-saw use. Training required for the operation of post-flood clearing equipment is in most cases more complex.

The benefits from a clearing program in the form of employment and training opportunities in the West Channel are not anticipated to be sufficient to justify its implementation.

(i) AESTHETICS

Public concern is currently being expressed over projects that destroy natural ecosystems and cause environmental degradation. Flooded vegetation and the associated accumulation of debris is aesthetically unattractive. As natural attrition is a slow process, any vegetation that is not removed prior to flooding will remain standing for a long period of time and will detract from the general appearance of the area.

THE PRESENT TIMBER CLEARING PROGRAM

The Department of Mines, Resources and Environmental Management established guidelines for timber clearing in the area between Kisipachewuk Rapids and Jenpeg[3]. Manitoba Hydro used these guidelines as the basis for their timber clearing program. The program, funded by Manitoba Hydro, will cost between $4,000,000 and $5,000,000 when completed this winter (1973/74).

The program will result in partial clearing of the West Channel. Only 13,340 acres[4] of the 21,821 acres that will be inundated, will be cleared. Stands and fringes of non-merchantable timber will be left in otherwise totally cleared areas. In addition, in areas characterized by gently sloping shorelines, only a relatively small amount of the total area to be inundated will be cleared.

The rationale for the set of guidelines established by the Department of Mines, Resources and Environmental Management, and the objectives of the present clearing program are not clearly defined. The aesthetics of the West Channel will not be enhanced by the present clearing program because stands of non-merchantable timber in otherwise cleared areas and timber on gently sloping banks will be flooded. In addition, only a relatively small amount of the timber has been salvaged and sold. The majority has been piled and burned. The program has provided limited employment and training opportunities.

The guidelines also call for consultation between Manitoba Hydro and the Department of Mines, Resources and Environmental Management within four years following the completion of the Jenpeg project to determine post-flood clearing requirements. The expenditure by Manitoba Hydro associated with post-flood clearing is not to exceed $1,000,000.

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[3] *See Appendix A for a complete set of guidelines.*

[4] *Preliminary figure ; subject to revision.*

RECOMMENDATIONS

1. Continuation of timber clearing in the West Channel during the coming winter (1973/74) should be reviewed with a view to reassessing costs and benefits, and giving consideration to other forms of mitigation that may be of greater priority particularly in the short-term.

2. If timber clearing is to be continued, guidelines for timber clearing by the Department of Mines, Resources and Environmental Management should be reviewed giving particular attention to

   (a) the justification for clearing to elevations 710, 713, 714, and 715 feet elevation,

   (b) leaving standing non-merchantable timber in cleared areas, and

   (c) a consideration of a freeboard area along the new shorelines of the forebay.

3. Resource research and management agencies should be contacted after flooding to

   (a) identify specific clearing requirements,

   (b) determine the least-cost method of underwater clearing,

   (c) evaluate the benefits of the proposed clearing,

   (d) compare clearing with other mitigation measures, and

   (e) plan an underwater clearing program if justified.

KISKITTOGISU LAKE

Contour mapping required for accurate delineation of the area to be flooded is not available for Kiskittogisu Lake. As the impact area cannot be defined, effects of flooding in this area have yet to be identified.

Generally, the shoreline of Kiskittogisu Lake ranges from low relief in the southern end to moderate relief in the northeastern end. The vegetation cover is a typical treed-muskeg. The low relief typical of this area suggests that a substantial area may be flooded.

Pre-flood clearing is no longer an option for Kiskittogisu Lake as little time now remains to map the area, determine the extent of clearing required and to initiate a program to meet the clearing objectives before impoundment in the spring of 1974. However, Kiskittogisu Lake should be considered a potential area for post-flood clearing.

RECOMMENDATIONS

After the reservoir has reached full pond, and the impacts of flooding timber in this area have been identified, resource research and management agencies in consultation with Manitoba Hydro, should evaluate the need for post-flood clearing at Kiskittogisu Lake.

TWO-MILE AND EIGHT-MILE CHANNELS

Regulation of Lake Winnipeg involves dredging two channels to increase discharge capacity[5]. Two-Mile and Eight-Mile Channels are being excavated between Lake Winnipeg and Playgreen Lake, and between Playgreen Lake and Kiskittogisu Lake, respectively. Effluent from these dredging operations is being deposited in designated sites called dredge spoil areas. The spoil limits for Eight-Mile Channel cover an area of approximately 50 sq. mi. The spoil area for Two-Mile Channel extends 10,000 feet on both sides of the channel. The actual area that will be inundated with dredge spoil will be much smaller than the area designated for its distribution.

Dredge spoil from both channels will be predominantly clay with some peat. The clay tends to be cut in chunks and is deposited as "balls". After deposition, these balls are highly compressible and disintegrate easily. The soil formed from this spoil is of an alluvial-like deposit. This will be a fairly productive soil and should support substantial vegetation.

Dredge spoil will kill all coniferous trees where clay or silt covers the trunk above the root collar. Brush such as willow and alder will generally survive by establishing new roots near the surface. Clearing the dead vegetation following the completion of dredging will enhance the aesthetic quality of the area and accelerate natural regeneration. A clearing program would also provide employment and offer on-site training for unskilled labour.

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[5] *Although a small portion of the Ominawin Bypass will be dredged, the amount of spoil will not be significant enough to warrant consideration of timber clearing as a remedial measure.*

Manitoba Hydro has indicated that following dredging, they will consult with forestry, soil science, and wildlife officials to consider redevelopment of spoil areas adjacent to the channels.

RECOMMENDATIONS

1. Manitoba Hydro should consult with socio-economic officials as well as forestry, soil science, and wildlife officials in the examination of redeveloping dredge spoil sites in order to identify employment and training opportunities.

2. Timber clearing should be evaluated and compared to other methods of aiding the redevelopment of dredge spoil sites after excavation has been completed.

APPENDIX "A"

Province of Manitoba
Department of Mines, Resources and Environmental Management
Environmental Management Division

Research Branch
909 Norquay Building
Winnipeg, Manitoba
R3C 0P8

July 20, 1972.

Mr. George Reid,
General Manager,
Administration and Finance,
Manitoba Hydro,
820 Taylor Avenue,
WINNIPEG, Manitoba.

Dear Mr. Reid:

Re: Jenpeg Forebay Clearing

During the past few months there has been much thought given to the question of an acceptable degree and pattern of timber clearing prior to raising water levels in the Jenpeg Forebay. Following various meetings and correspondence involving representatives of Manitoba Hydro, the Department of Tourism and Recreation, Parks Branch and the Department of Mines, Resources and Environmental Management, we appear to have reached accord on the conditions for clearing. Thinking it best, for the sake of good order, I am setting out, as follows, these conditions as we understand them to be:

1. All merchantable timber to be cleared to elevation 715 feet. (Merchantable timber is defined as trees falling into the 4" diameter class and 30 feet height class and larger).

2. All islands will be cleared. (to elev 715') [illegible]

3. Where the banks are steep and the difference in area between elevation 713 feet, 714 feet and 715 feet is small, clear to 715 feet.

4. Where the river banks are well defined along the main water course, clear to elevation 713 feet starting at the control structure on upstream to the junction of the West Channel and Metchanais Channel. The remainder of the channels proposed for clearing would be cleared to elevation 714 feet.

5. Where the river banks have a mild slope and flooding will occur over a wide area along and away from the natural river channel, clear to elevation 710 feet.

6. Where there are draws or flood plains away from the river which can be isolated by booms, clear to the boom location.

7. Clear to all dykes that will have water against them. Freeboard dykes are excluded.

8. Clear areas required for docks and/or landings.

9. Clear and grub any area designated as a recreational area.

10. Provide cleared areas to ground level at intervals of three miles along the navigation channel to allow an approach to the shoreline in order that boats could be launched at these locations, or to provide access to the shoreline.

11. Within four years following the completion of the Jenpeg project, should the Department of Mines, Resources and Environmental Management in consultation with Manitoba Hydro decide that additional clearing should be performed, Manitoba Hydro would undertake to have this clearing performed through periods of low water, provided the expenditure associated with this additional clearing will not exceed $1,000,000.00.

Such conditions as stated above are respected as practical measures to alleviate damage to the environment and their intent is regarded as acceptable by the Environmental Division of the Department of Mines, Resources and Environmental Management. It is my understanding that they are similarily acceptable to the Department of Tourism and Recreation, Parks Branch - in particular, the special treatment indicated to your Mr. Jack Callum by Mr. W. W. Danyluk as being required for three identified recreational sites on the main channel.

I trust that Manitoba Hydro agrees that the above represents an accurate description of mutually acceptable conditions for clearing. If you find that you require further information and/or clarification from us, I would be grateful if you will advise me as soon as possible.

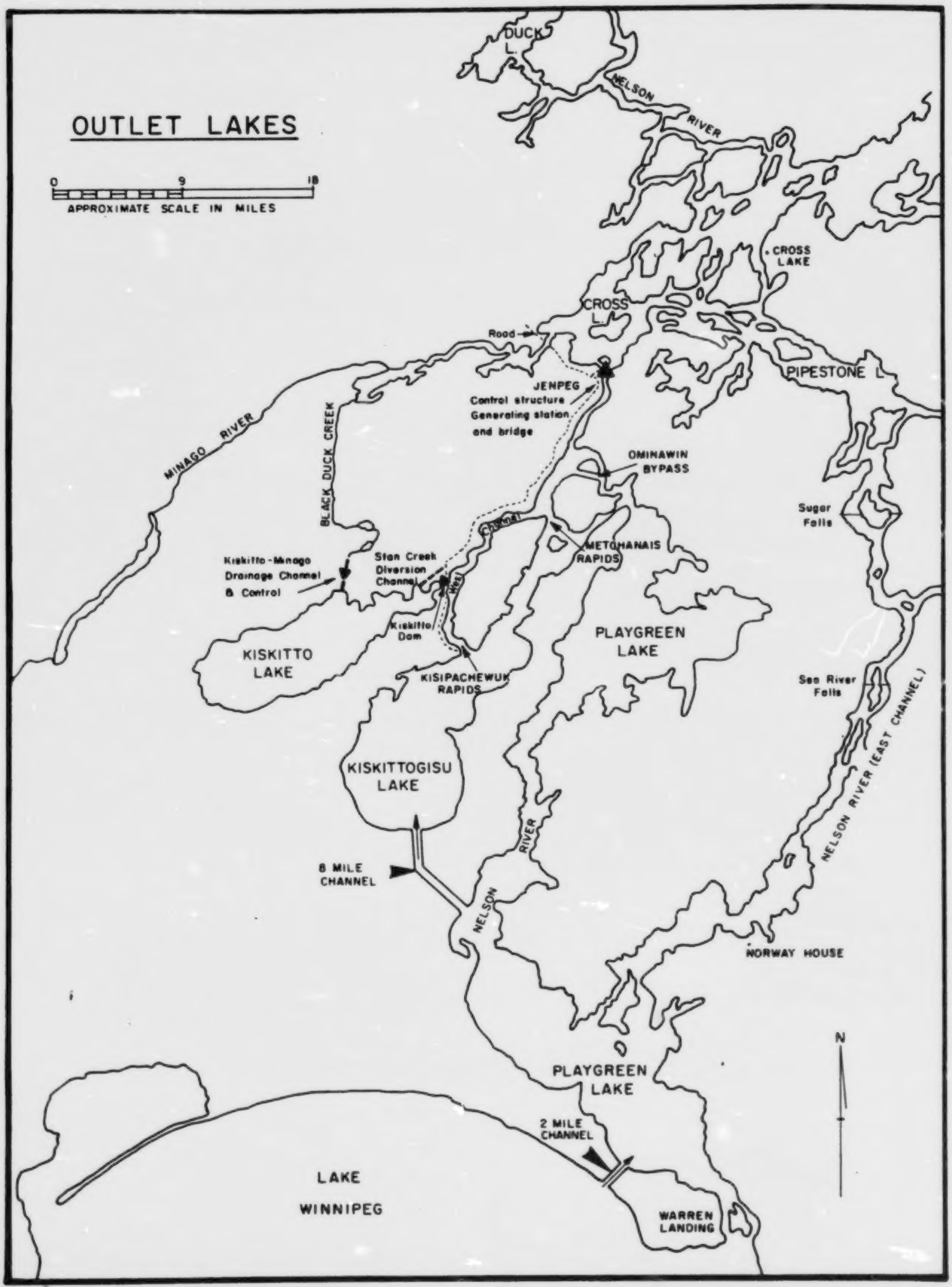
Yours truly,

W. George Bowen

W. George Bowen,
Assistant Deputy Minister.

WGB/si

c.c. Hon. E. Schreyer
Hon. L. Evans
Hon. L. Desjardins
Mr. R. A. Wallace
Mr. O. S. Eagleton
Mr. J. Callum
Mr. H. Hopper
Mr. D. E. Cline
Mr. J. Collinson
Dr. K. Doan
Mr. A. Kotowycz
Mr. M. Kaye


OUTLET LAKES
0
9
18
APPROXIMATE SCALE IN MILES
DUCK L.
NELSON RIVER
CROSS LAKE
CROSS L.
Road
JENPEG
Control structure
Generating station
and bridge
PIPESTONE L.
MINAGO RIVER
BLACK DUCK CREEK
OMINAWIN BYPASS
Sugar Falls
Channel
METCHANAIS RAPIDS
Kiskitto-Minago Drainage Channel & Control
Stan Creek Diversion Channel
Kiskitto Dam
KISKITTO LAKE
KISIPACHEWUK RAPIDS
PLAYGREEN LAKE
Sea River Falls
NELSON RIVER (EAST CHANNEL)
KISKITTOGISU LAKE
8 MILE CHANNEL
NELSON RIVER
NELSON
NORWAY HOUSE
N
PLAYGREEN LAKE
2 MILE CHANNEL
LAKE WINNIPEG
WARREN LANDING

APPENDIX 1 - P

LONG TERM ECOLOGICAL MONITORING OF THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS IMPACT AREAS

LONG TERM ECOLOGICAL MONITORING OF THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS IMPACT AREAS

by

J. F. SHAY, J. THIE, C. FARNOCAI,
G. MILLS, H. AYLES, G. ADAMS, J. STEWART
Winnipeg, Manitoba
January, 1974

CANADA - MANITOBA

LAKE WINNIPEG, CHURCHILL and

NELSON RIVERS STUDY BOARD

c/o Water Planning & Management Branch,
Department of the Environment,
Ottawa, Ontario. K1A 0H3

January 3, 1974.

The Honourable Jack Davis,
Minister, Environment Canada,
OTTAWA, Ontario.

The Honourable Sidney Green, Q.C.,
Minister, Manitoba Department of Mines,
Resources and Environmental Management,
WINNIPEG, Manitoba.

Mr. L. A. Bateman, P. Eng.,
Chairman, Manitoba Hydro,
WINNIPEG, Manitoba.

Gentlemen:

The federal-provincial Study Agreement, under Item 5 (b), requires that "the final report will include recommendations for further measurements, sampling or investigations as may be desirable to provide at a later date an accurate record of the before and after effects" of the Manitoba Hydro works specified in the Agreement.

Additional "baseline" data is required prior to flooding to assess the impact on the ecology. The short lead time available to establish the "baseline" ecological condition concerns the Board, therefore, the attached proposal titled "Long Term Ecological Monitoring of the Lake Winnipeg, Churchill, Nelson Rivers Impact Areas" is being forwarded at this time.

The program to complete the collection of "baseline" ecological data and to carry out the necessary monitoring will require an expenditure of approximately $750,000 over a period of seven years.

The information obtained from the monitoring program will be invaluable for resource management purposes and for identifying further mitigation measures. The program will also provide valuable information for assessment of the ecological impact of other northern developments.

The Board recommends that the study requirements as outlined in the attached proposal be forwarded to the Canada-Manitoba Advisory Committee on Water for their consideration and action with a view to implementing the program to take advantage of the 1974 summer field season.

Yours sincerely,

N. H. James,
Chairman.

Enc.

b.c. N. H. James
C. J. Goodwin
J. T. Cawley
E. W. Humphrys
N. Mudry
J. R. Vallentyne

LONG TERM ECOLOGICAL MONITORING OF THE LAKE WINNIPEG, CHURCHILL, NELSON RIVERS IMPACT AREAS.

A PROPOSAL BY

J.F.SHAY, J.THIE, C.TARNOCAI, G.MILLS, H.AYLES, G.ADAMS, J.STEWART.

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PREAMBLE

Diversion of waters, engineering works and flooding, which are part of the important Lake Winnipeg, Churchill and Nelson Rivers, hydro-electric development scheme, will have a considerable impact on large parts of the Northern Manitoba environment.

Short term multi-disciplinary studies and surveys under direction of the Lake Winnipeg, Churchill and Nelson Rivers Study Board will be carried out over a period of three years to determine the effect of the Manitoba Hydro Project on water and related resources. On the basis of these somewhat qualitative and speculative assessments, recommendations by which to minimize detrimental effects and maximize the beneficial efforts will be forwarded to federal and provincial ministers and Manitoba Hydro.

To more accurately assess the effects of this development scheme on the environment, long term monitoring of the impacted areas is necessary. Only by such long term environmental studies (5-10 years or more) can we expect to assess and quantify changes. This will enable us to learn effectively from mistakes and successes. Knowledge gained would be of considerable importance in other developments projects in the north.

Dr. I. W. Dickson, Study Director, Lake Winnipeg, Churchill and Nelson Rivers Study requested Dr. J. M. Shay, Ecologist, University of Manitoba to organize and coordinate a multi-disciplinary group of environmental specialists to prepare a study proposal*for a long-term monitoring program to determine environmental effects associated with the major power development in Northern Manitoba.

*Note: Because of delay in preparation and Board approval of this study proposal, and, in anticipation of further delay associated with consideration and implementation of the proposed program, Board staff have updated those aspects of the proposal concerning timing and associated costs of proposed studies.

INTRODUCTION

To describe environmental impact is a difficult and complex undertaking. Environmental changes associated with resource management practises of mankind, in this case the hydro-electric development scheme, have to be assessed in relation to the natural changes as result of the normal dynamic behaviour of the environment.

To be able to adequately assess the changes in the environment caused by the scheme, it is essential to identify and study all critical parameters involved, their interrelationships; then evaluate the influence of the changing parameters, in this case usually flooding, changed watertables, changes in heat budget, vegetation, etc.

In the proposed approach a number of representative ecosystems will be selected in the impact area, based on the Biological-Physiographical Survey carried out by the Soil Survey of Manitoba and based on the experiences of the disciplinary surveys. All elements of these ecosystems will be studied by a team of specialists. These elements can be grouped as:

soil related
vegetation related
water related
wildlife related

The following pages discussing methodology, cost estimates, objectives, operational aspects, etc., are based on discussion and special contributions in the form of detailed technical reports by Dr. G. Adams, Canadian Wildlife Service, Dr. J. Shay, Department of Botany, University of Manitoba and Mr. C. Tarnocai and G. Mills, Manitoba Soil Survey, Mrs. H. Ayles, Freshwater Institute, Mr. J. Thie, Department of Mines, Resources and Environmental Management.

SUMMARY

OBJECTIVE To assess and monitor long term environmental changes attributed to artificial manipulation of water levels and flows.

METHOD A multi-disciplinary or multi-agency study team will evaluate the changes occurring in the vegetation, wildlife, soils and water elements of representative ecosystems in the impact areas. Monitoring intervals may vary from days to a number of years. Because of the use of airborne and satellite remote sensing techniques, in addition to conventional ground sampling, repetitive surveys can easily be accomplished, while findings in selected ecosystem can be extrapolated over the total impact area at an unusually low cost.

TIME PERIOD

Phase I and II: Selection and survey of sample ecosystem before development.
Phase III : Monitoring of selected ecosystem using a combination of conventional and remote sensing techniques.
Phase IV : Data interpretation and assessment of change;

Minimum of seven years from the start of phase one:
minimum of five years from the start of flooding.

Monitoring of some parameters (selected by disciplines after the first 5 years) may have to continue for periods up to 30 years.

COST

Monitoring Per Year:	
vegetation	20,000
soils	20,000
wildlife	20,000
water	20,000
remote sensing	20,000
co-ordination	10,000
	$110,000

Total for project	
Site selecting	$ 10,000
6 years monitoring	$660,000
Analysis & reporting	$ 80,000
Total	$750,000

ORGANIZATION Co-ordinator agency - similar to Lake Winnipeg, Churchill, Nelson Rivers Study Board or e.g. Manitoba Remote Sensing Centre, with sub-contracts from Federal Department, Provincial Department, and Universities.

METHODOLOGY

To identify the present conditions and relationships of the selected ecosystems a survey of the conditions before flooding has to be carried out. This would provide the base line information for comparison and assessing impact. Because of the timetable for the development, this survey would have to be done before 1975. Parameters to be measured are identical to the ones for the monitoring phase and are described later.

SURVEY BEFORE FLOODING

Phase I - selection of representative ecosystems and sample areas by the Bio-physical group during 1974, based on results of studies in progress directed by the Study office.

Phase II - analysis and detailed description of selected ecosystems during the winter of 1974-75 and summer 1975.

The characteristic ecosystem parameters will be measured on a repetitive basis. Intervals may be yearly, seasonally, weekly or daily, where required.

MONITORING AFTER FLOODING

Phase III - repetitive surveys of selected ecosystems.

Phase IV - data interpretation and assessment of change; recommendations.

For the initial survey and subsequent monitoring after flooding extensive use of the most up to date Remote Sensing techniques will enable a team of specialists to describe areas and assess change at a relatively low cost. With the use of airborne and satellite imagery costly ground surveys can be reduced to the minimum. With remote sensing techniques extrapolation of the results to non-sampled areas becomes possible for only a relatively small investment. Facilities of the Manitoba Remote Sensing Centre, and sophisticated interpretation equipment are assumed to be available to the monitoring team.

ECOSYSTEM SURVEY

The surveys in the different phases will be carried out by a team of specialists working in a closely co-ordinated manner and organized along the following elements of the ecosystem: Land, Vegetation, Water and Wildlife. Remote Sensing is added because of its special importance and capabilities to this study. Each of the elements is discussed in detail according to objectives and methods of approach. The following information is abstracted from the detailed reports submitted by C. Tarnocai and G. Mills (Land); G. Adams (Wildlife); J. Shay (Vegetation); J. Thie (Remote Sensing) and H. Ayles (Water).

land

Objective: To determine the impact of water level changes on the soil and permafrost systems.

In order to determine the effect of changes of water level on the soil and permafrost systems the following data should be collected and monitored both prior to and subsequent to water level changes:

1. Initial characterization of chemical and physical properties of soils of representative ecosystems.

2. Installation of observation wells on representative ecosystems to determine the water table levels before and after flooding and to sample the ground water periodically in order to determine the changes of ground water quality.

3. Installation of thermocouples on each subject to determine the alteration of thermal regime due to water level changes.

4. Periodic resampling of the soil system to determine the changes in its physical and chemical properties.
   Continuity: Monitoring to be maintained for at least
   1 year prior to and 5 years after the water
   level changes take place.

5. Periodic resampling of the perennially frozen soils to determine the alteration of permafrost properties (i.e. changes of moisture and ice content of the active and permafrost layers).

vegetation

Objective: To monitor the vegetation and associated environmental factors before flooding and the changes after flooding.

Phase I. 1974 The proposed biophysical survey will locate major ecosystems from which study sites will be selected.

Phase II. Winter 1974-75 and summer 1975.

(1) Compiling an inventory of the components of the vegetation. Each stratum will be examined - moss herb, shrub and tree in order to determine the plant community structure. A reference collection of plants will be made.

(2) Quantitative data will be obtained from the principal plant communities to provide a baseline against which changes can be measured after flooding.

(3) Each site selected for study will be characterized by vegetation and the associated physiochemical components in order to record the key ecosystemic parameters prior to any water level change.

Phase III. 1976/80 Using the data from Phase I and II a representative selection of major plant communities will be selected for intensive monitoring. The monitoring program has to be continued for at least 5 years after flooding.

Permanent transects and quadrats will be set up. Water quality pH, conductivity, organic matter content of the soil. Soil texture will be analysed and compaction measured. Close cooperation between the vegetation program and the land program should avoid duplication of effort in relation to soil and water data gathering.

water

Objective: To record any changes in water quality and fauna that would result from the water diversions and flooding.

Because this study is to monitor changes and not to research all affected aspects of the water environment, it has been organized to include only those data that may act as indicators for many other features.

It is visualized that after an initial intensive study of water quality, subsequent observation can be made from simpler, less intensive field techniques. The remote sensing provided for this program will be used to supplement the water data with information on changes in flow patterns and ice patterns as well as the possibility of information on changing turbidity values.

The fish populations are slower in their response to environmental changes so that the first intensive fish study need not occur until several years following the diversion.

Phase I 1974

Selection of those areas that will typify changes occurring throughout the water system.

Phase II Winter 1975-75 and summer 1975.

Compilation of available information on the selected areas. Collection of any remaining data required.

Phase III

Monitoring of subsequent changes, the program to take this form:

1. For the year following the flooding and for at least one year more, a relatively intensive study of water quality to be conducted. This part of Phase III should sample the study areas throughout the year.

2. Thereafter the water quality to be monitored using secchi disc readings to indicate change in turbidity.

3. During the first five years following flooding fish populations to be monitored through commercial fish catch statistics.

4. Approximately five years following flooding a relatively intensive study be made to monitor changes in fish populations and food available.

5. The intensive fish study to be repeated again at a later date.

wildlife

Objective: To monitor impact of changes in water regime (large scale impoundments, manipulations of flow and water diversions) upon the wildlife habitats and associated wildlife populations and wildlife use and recommend management or mitigation measures.

An inventory of species and an assessment of their responses to environmental changes should involve the determination of the following ecological and population parameters. Measurements of most of these parameters may require considerably more than one year of inventory, and others require a research input. For convenience, the species concerned should be grouped according to taxonomic relationships and habitat affinities into the following categories: migratory birds, resident game birds, waterfowl, big game, furbearers, and other non-game mammals. Where possible the study should attempt to monitor the following parameters: species diversity, interactions and trophic relationships; distribution of populations, density and spatial distribution of individuals; temporal distribution patterns, productivity, migratory patterns, consumptive and non-consumptive use.

Phase I - 1974 On the basis of work completed by the Bio-physical and wildlife teams of the diversion study, ecosystems or combinations of ecosystems will be selected for detailed description and monitoring.

Phase II - Winter 1974-75 and summer 1975

Compilation of available information on areas selected for monitoring. Collection of any remaining data required to form an accurate basis. Monitoring of selected ecosystems by means of ground, aerial and remote sensing surveys.

Phase III

Isolate the important environmental factors governing wildlife population distributions and interpret how they are influenced by changed water regimes. Relate population levels and indexes of wildlife use to changes in habitats such as plant succession as influenced by altered water regimes. Relate impacts on wildlife to known effects of existing water diversions and impoundments located elsewhere. Develop a predictive model that correlates changes in ecosystems with habitat affinities and population dynamics of key wildlife species.

Phase IV - Recommendations:

1. Designate important natural ecosystems that would support

a diversity of species, or that would contain endangered species such as the colonial birds, or that serve as key production or staging areas. Recommend procedures for safeguarding some of these areas.

2. Delineate and describe areas that may function as replacement habitat for wildlife species, given proper management inputs.

3. Assess the current use and demand for the existing wildlife resources in the affected area and project estimates of wildlife gains or losses.

remote sensing

Objective:

To provide airborne and satellite remote sensing data essential to the efficient and low cost monitoring of ecosystems by the land, water, wildlife and vegetation study team.

To provide special instrumentation expertise and equipment to the study team and to assist in the extrapolation of information to non-sampled impact areas.

Method:

As a part of the Canadian and Manitoba Remote Sensing programs the selected representative ecosystem will be surveyed by airborne platforms from different altitudes according to specifications by the study team (altitudes 3,000, 10,000, 35,000 ft. A.S.L.) at day and night times; where necessary at particular times during the year, as to enable to study the dynamic aspects of ecosystems. Infrared scanners, multispectral scanners, radar and microwave equipment may be used in combination with multiband photographic sensors. These sensors can be applied to study such parameters as soil texture, soil surface temperature, permafrost, groundwater discharge, erosion, vegetation stress (moisture), disease, phenology related to water fluctuations, vegetation temperature, evapotranspiration, micro climate, regional climate, wildlife trails, possible movements, habitat, water turbulence, sedimentation load, shoreline erosion, water temperature, organic debris, etc.

Special instrumentation like Bausch and Lomb zoom stereoscopes, double scanning stereoscopes, color density slicers, scanning densitometers, color additive viewers, computers, etc. will be available to the study teams to analyse the remote sensing data. Also special remote sensing expertise will be able to provide assistance in the interpretation of data and the design of groundtruth studies.

The ERTS satelllite is presently providing good quality imagery of the study area in 4 bands of which two are in the visible part (4,5) and two are in the infrared part of the spectrum (6,7). Satellites have already shown their ability to assist in monitoring turbidity in water, water level change, forest fires, plant succession and waterflow in Northern rivers in a general way.

OPERATIONAL ASPECTS

Co-ordination of efforts will be important in this type of study. It is suggested that a special co-ordinator will be required to meld data gathering of the different disciplines and the evaluation in the later stages. This person could be an employee of the University of Manitoba, Province of Manitoba, or any other agency which may play a major contributing role to the monitoring aspects.

The monitoring of the selected ecosystem could be carried out via contractual arrangements with the University and its departments. However, from logistics, interest and efficiency point of view it may be more desirable to compose a study team of representatives from the major interested agencies: Province of Manitoba (Dept. of Mines, Resources and Environmental Management), Manitoba Hydro, Federal Departments, Universities of Manitoba and Winnipeg and present contractors of the Lake Winnipeg, Churchill and Nelson Rivers Study Board. In this way we will be able to draw on all existing expertise, facilities and instrumentation, and include in the evaluation process all interested parties.

As all disciplines will lean heavily on remote sensing techniques and special instrumentation it is suggested that the Manitoba Remote Sensing Centre could act as the co-ordinating agency. Expertise of the Centre or seconded to the Centre could do part of the contract work or work in association with contracting agencies.

FINANCING

On the basis of the detailed reports submitted by Dr. G. Adams, Dr. J. Shay, Mr. C. Tarnocai, G. Mills, Mrs. H. Ayles and J. Thie, the total man-year involvement, field expenses, etc. were estimated. These estimates are approximate and only identify the magnitude of cost associated with the proposal. For some years the cost may be lower, for some years higher than anticipated. Summarized as follows:

Phase I -	1974	All disciplines (Total)	$ 10,000	
Phase II -	Winter 1974-75 and summer 1975	Vegetation	20,000	
		Soils	20,000	
		Water	20,000	
		Wildlife	20,000	
		Remote Sensing	20,000	
			$100,000	
		Coordination	10,000	
			$110,000	per year
Phase III and IV	1976	All disciplines (Total)	110,000	
	1977	All disciplines (Total)	140,000	
	1978	All disciplines (Total)	110,000	
	1979	All disciplines (Total)	110,000	
	1980	All disciplines (Total)	160,000	
		Total	$630,000	
Total cost of Phases I, II, III, IV			$750,000	

APPENDIX 1 - Q

RECOMMENDATIONS OF STUDY PARTICIPANTS FOR PRE-FLOOD CLEARING ON SOUTHERN INDIAN LAKE AND THE DIVERSION ROUTE

RECOMMENDATIONS OF STUDY PARTICIPANTS FOR PRE-FLOOD CLEARING ON SOUTHERN INDIAN LAKE AND THE DIVERSION ROUTE

by

B. NOWICKI
Lake Winnipeg, Churchill and Nelson Rivers Study Office
Winnipeg, Manitoba
April, 1974

for

THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

SPECIAL NOTE

The conclusions and recommendations contained in this appendix are those of the author(s) and are not necessarily the same as the conclusions and recommendations of the Lake Winnipeg, Churchill and Nelson Rivers Study Board as expressed in the Summary Report and the Technical Report.

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INTRODUCTION

Participants in the Lake Winnipeg, Churchill and Nelson Rivers Study have evaluated timber clearing as a measure for mitigating the effects of flooding resulting from the diversion of the Churchill River. This report contains a summary of the pre-flood timber clearing recommendations that were identified by study participants. A description of Manitoba Hydro's current pre-flood timber clearing program is also included. The pre-flood timber clearing recommendations contained in this report were compiled in the Study Office but have not been endorsed by the Board.

The Churchill River Diversion project is one aspect of the total hydroelectric development of the Nelson River. It involves the diversion of the Churchill River at Southern Indian Lake to the Nelson River via the Rat-Burntwood rivers (see Fig. 2) and will result in a 10-foot increase in the level of Southern Indian Lake, and, as much as an eight-fold increase in flows in the Rat-Burntwood rivers.

Diversion of the Churchill River at Southern Indian Lake will cause flooding of existing land surfaces in three areas:

(1) Southern Indian Lake and the Churchill River as far upstream as Granville Lake;

(2) the diversion route between South Bay on Southern Indian Lake and the Notigi control structure on the Rat River; and

(3) the diversion route downstream of the Notigi control structure to Split Lake.

The increase from the present level of Southern Indian Lake to a maximum elevation of 850 feet will flood 212 sq. miles (135,000 acres) at Southern Indian Lake and along the Churchill River as far upstream as Granville Lake. Fifty-nine percent of this area is timber covered, 31 percent is treed muskeg, and 10 percent has no forest cover.

Along the diversion route between South Bay on Southern Indian Lake and the Notigi control structure on the Rat River, 158 sq. miles (101,484 acres) are likely to be flooded. Forty-eight percent of this area is timber covered, 44 percent is treed muskeg, and 8 percent has no forest cover.

The area that will be flooded below the Notigi control structure with diversion is still being calculated, but has been estimated to be 50 sq. miles[1].

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[1] *Underwood, McLellan & Associates, "Rat-Burntwood Mitigation Report", prepared for Manitoba Hydro, January, 1974, p.34.*

MANITOBA HYDRO PRE-FLOOD CLEARING PROGRAM

CONTRACTS AWARDED

Manitoba Hydro has allocated a total budget of $11,000,000 for clearing prior to the diversion of the Churchill River. Of the $11,000,000 budget, contracts valued at $5,500,000 have been awarded.

Five million dollars have been awarded for clearing at Missi Falls and along the diversion route from South Bay to the Notigi control structure (see Fig. 3). This clearing is for hydraulic purposes. The additional half million dollars have been awarded for clearing at South Indian Lake community and along the west shore of South Bay (see Fig. 3). The purpose of clearing at these sites is explained in the following sections.

1 - SOUTH BAY

Study participants examined the clearing contract for the west shore of South Bay. They anticipated that within 10 years the winter road, which parallels the west shore of South Bay and connects the community of South Indian Lake with the Hydro dock at South Bay, will be replaced by an all-weather road. This would make South Bay and South Indian Lake accessible from Provincial Road #391. The increased accessibility is expected to increase travel to this area. It is also anticipated that the west shore of South Bay will be used by travellers for boating and fishing.

The South Bay contract is to slash clear 1000 acres along the west shore. Debris will not be disposed of prior to flooding. Study participants examined the contract and concluded that it is highly unlikely that debris will be blown upstream into the vicinity of the community. Slash should remain along the shoreline. However, if, after flooding, debris is being blown upstream into the community, booms placed at strategic points south of the community would alleviate this problem.

2 - SOUTH INDIAN LAKE

The South Indian Lake clearing contract is to cut, pile and burn vegetation covering 600 acres in and around the community. Participants agreed that this would hasten the re-establishment of a natural shoreline at the community. It would also prevent the development of shoreline access problems for residents after flooding.

AGREED TO FUND

In addition to the $5,500,000 in contracts which have been awarded, Manitoba Hydro has agreed to provide funds for clearing at landing sites and whitefish spawning sites on Southern Indian Lake, at Loon Narrows fish camp and at Long Point creek (see Fig. 3). These sites were identified by Study participants and discussed with Hydro prior to the writing of this report. The logistics of clearing these areas are currently being planned and clearing is expected to begin at some sites early this spring.

1 - LANDING SITES

Approximately 100 landing sites will be cleared on Southern Indian Lake. This is to ensure that, after flooding, boats will have access to the shore during storms or other emergencies. Sites of 1/2 acre will be cleared at a minimum of one every three miles.

A representative of Manitoba Hydro has discussed this clearing program with fishermen at South Indian Lake, and they have not recommended any changes in landing locations. However, one or two local fishermen will accompany survey crews and aid in the selection of exact locations.

2 - WHITEFISH SPAWNING SITES

Manitoba Hydro will fund the clearing this winter of 75 acres on islands in the northern portion of Southern Indian Lake. This area is part of a pre-flood experimental clearing program requested by the Fisheries Study component as an attempt to ensure that suitable whitefish spawning sites will be available after flooding.

Whitefish are the most important species in terms of total catch in the Southern Indian Lake fishery. On the average they compose 95 percent of the total winter commercial catch and 86 percent of the total summer catch. The winter and summer fisheries combined provide 43 percent of the community income at South Indian Lake. The fishery is the most single important source of livelihood in the community.

After flooding, suitable spawning sites for whitefish could be limited and this would reduce spawning success and contribute to a decrease in their abundance. Pre-flood clearing, grubbing and removal of the overburden at specific sites may help protect existing spawning sites and ensure that suitable whitefish spawning sites are available after flooding.

Manitoba Hydro is not committed to clear more than 75 acres. Fisheries has suggested that the costs of clearing each island be recorded so that the relative costs of different types of clearing can be compared with the expected benefits. On the basis of this evaluation, Hydro and Fisheries will determine whether the remainder of the identified sites should be cleared.

The Freshwater Institute of the Department of Environment Canada will monitor these sites and evaluate their occupancy by spawning fish after flooding.

3 - LOON NARROWS

Vegetation along the shoreline for one mile on both sides of the fish house and camp facilities, will be cut, piled, and burned to the new high water line plus two feet. Approximately 75 families camp and fish annually at this site, and it is anticipated that they will continue to do so after diversion.

4 - DYNAMITE CREEK

Dynamite Creek is the local name for a creek at the base of Long Point peninsula on Southern Indian Lake. Vegetation along this creek will be cut, piled, and burned to 500 feet on both sides or to the 850-foot contour whichever is less. This creek is used by small boats as a short route from Loon Narrows fish camp to the communities of South Indian Lake and Leaf Rapids. After diversion the water level in this creek will be approximately 10 feet higher and will be deep enough to permit the passage of freight boats. Clearing along the existing shorelines will ensure that freight boats can be safely navigated through this creek.

ADDITIONAL SITES RECOMMENDED FOR PRE-FLOOD CLEARING

Progress in and completion of studies have led to the identification of additional sites which should be cleared prior to flooding. This section outlines the rationale for clearing each additional site, the degree of clearing required and the cost.

This list should not be considered as final. As additional studies are completed, more sites may be identified.

Pre-flood clearing requirements at Nelson House have not been outlined in this report because they have been dealt with in a separate report on the community.

SITE LR-01

-- The inlet immediately downstream of Leaf Rapids on the south side of the Churchill River (Fig. 4).

This inlet is heavily used by the 2100 residents of Leaf Rapids as a recreation site. The southern extremity of this inlet is only a five minute walk from the townsite. In the summer, residents picnic, hike, and launch their boats along this inlet. In the winter the bank at the southern tip of the inlet is used as a ski hill. Recreational use of this site is anticipated to increase as the population of Leaf Rapids reaches its planned size of 15,000.

The flooding that will occur because of diversion will likely enhance the recreation potential of this inlet if it is cleared prior to flooding. Increased water levels will make swimming possible and launching boats and canoes will be easier. Vegetation should be cut, piled, and burned, and the area grubbed to the new high water level plus two feet. The cost of clearing and grubbing the estimated 250 acres along this inlet will be approximately $120,000.

Sites CR-02, CR-03, BR-01, BR-02 (Fig. 4); SIL-08, SIL-11 (Fig. 5); SIL-12, SIL-19 (Fig. 6).

-- Specific rivers entering Southern Indian Lake, Opachuanau Lake, and the Churchill River.

These sites have been identified as the major spawning sites for walleye. Walleye are an important species in terms of total catch in the summer and winter fishery of Southern Indian Lake, and could be important in the development of sport fishing and tourism in this area.

Walleye, on the average, compose 13 percent of the total commercial catch of the Southern Indian Lake summer fishery, but have been as high as 26 percent. They compose only 4 percent of the total commercial catch of the winter fishery. However, the price per pound paid to commercial fishermen is more than 3.5 times as high for walleye as it is for whitefish.

Commercial fishing on Southern Indian Lake contributes 43 percent of the income to the community of South Indian Lake, and as noted above is the most important source of employment in the community.

At present, sport fishing is limited to the Churchill River near Leaf Rapids, and the Barrington River. However, as access to this area increases, sport fishing is expected to draw tourists to the area. While walleye are not anticipated to be the main reason to sport fish in this area, they offer an attractive alternative for sport fishing tourists.

The flooding that will result from the diversion of the Churchill River could reduce the size of the walleye population in Southern Indian Lake. Changes made to the particular spawning sites by the raising of the water level, as well as changes in water movement within the lake that could change the methods for homing, could reduce the number of successful spawners enough to harm the size of the walleye population. In addition, changes in water flow in streams by raising the water level would increase sedimentation rates on the existing spawning grounds which would have an adverse effect on incubating eggs.

It is likely that adequate spawning grounds will be established at higher positions on the streams that will not be directly affected by flooding. However, to ensure spawning sites are available, the vegetation along the shorelines of rivers entering the Churchill River and Opachuanau Lake (see Fig. 4) should be cleared and burned to the new high water level plus two feet. The rivers entering Southern Indian Lake (see Figs. 5 & 6) should be cleared from 100 yards downstream of the foot of the present rapids, upstream to the point where the new high water contour plus two feet intersects the rivers.

The total area to be cleared is approximately 550 acres. Manitoba Hydro has estimted clearing in these remote areas would cost $1500 per acre. Based on these figures, total cost for clearing to ensure suitable walleye spawning sites are available after flooding is $825,000.

SITES SIL-13, SIL-14, SIL-15, SIL-16, SIL-17 AND SIL-18 (Fig. 6). -- Islands on the Northern Section of Southern Indian Lake.

Ten islands have been identified as the location of nesting colonies for two species of terns (the Caspian tern and the common tern) and two species of gulls (the herring gulls and ring-billed gulls) on Southern Indian Lake. Several thousand pairs of birds in densities of up to 3 to 4 hundred pairs were found in single colonies.

These ten islands will be completely inundated with the diversion of the Churchill River. Suitable nesting sites will not be available after flooding, and the gull and tern population of the lake will be reduced to extremely low numbers until natural processes re-establish suitable sites. Natural processes are very slow and it could take many years until suitable sites are restored.

Cutting, uprooting, and burning trees and large shrubs above the flood level on select islands would provide suitable nesting sites and help prevent the disappearance of these species from Southern Indian Lake.

Aerial mosaics were examined and 12 potential sites were selected (see Fig. 6). The six sites listed in the above title appeared to be the most suitable. However, Study participants recommend that a biologist inspect all sites prior to any clearing to determine the best sites and the extent of clearing.

The following requirements should be considered when a final decision is made on which islands will be cleared. Firstly, elevation must be higher than 850 feet, but not much higher than 855 feet. This would give a maximum elevation of 5 feet, which is slightly greater than the average height of existing nesting islands. Secondly, trees and large shrubs should be cut, uprooted and burned on all of the islands above flood level. Some small shrubs could be left in the center of the island if possible. Thirdly, an effort should be made to leave as little of the substrate as possible. Small pockets of soil should be left for the growth of forbs and grasses. These plants provide nesting material. Some areas of open sand should also be left for Caspian terns.

Manitoba Hydro has estimated the cost of clearing up to 3 acres on each of the six islands could cost $10,000 per island. The total cost of clearing the six islands could be as high as $50,000 - $60,000.

SITES SIL-117, SIL-122, SIL-123, SIL-121 (Fig. 4); SIL-252-251, SIL-253, SIL-180, SIL-130 (Fig. 5)
-- on Southern Indian Lake and

SITES UNR-26 AND UNR-4 (Fig. 7)
-- on the Burntwood River.

These sites are scheduled for archaeological investigation this summer and next, and will have to be cleared prior to excavation. In the past archaeological crews have cleared excavation sites. However, the sites listed above are more heavily treed than sites previously excavated. Archaeological crews are not trained in clearing techniques and could incur serious injury if they have to clear these sites. In addition, clearing prior to commencement of the archaeology field season will allow more time for excavation.

Archaeologists have recommended that trees be hand cut one foot above ground level so as not to disturb the root systems, and ground surface. The slash should be piled and burned and the large logs decked to be used in the construction of cabins for archaeology crews. An archaeologist should supervise the clearing program.

The area to be cleared at each site varies from less than half an acre to just over two acres (see Table 1). The total area of these sites is approximately seven acres, and Hydro has estimated that it will cost about $2000 per acre to hand clear these sites. Based on this information the total cost of clearing is estimated to be $14,000.

SITE SR-01 (Fig. 1)
-- The Suwannee River.

All streams between Issett Lake and the Notigi control site known to have walleye spawning runs, will be entirely inundated following impoundment. Inundation of the streams will make them useless as walleye spawning sites. The loss of suitable spawning sites could lead to a decrease in walleye population in the Rat River system.

Present exploitation of walleye in this system for commercial and sports purposes is limited. There is a small commercial fishery on the Rat-Burntwood system and walleye compose approximately 15 percent of the total catch. Sports fishing is limited but with the increased accessibility of this area provided by Provincial Road #391 and the growing demand for northern recreation, some future development is anticipated.

To ensure suitable walleye spawning sites are available after diversion, vegetation along the Suwannee River should be cut, piled, and burned from the intersection of the new high water contour and the river, downstream to where it presently enters Rat Lake. The effectiveness of this clearing in providing suitable sites is uncertain because the present status of the Suwannee as a spawning stream is unknown. However, it will be only partially inundated and sufficient stretches of rapid water may remain to provide spawning sites.

This program would involve the clearing of approximately 750 acres and has been estimated by Manitoba Hydro to cost $500 per acre. The total cost would be $375,000.

SITES NR-01, NR-02, NR-03, NR-04, NR-05, NR-06, NR-07, NR-08, NR-09, NR-10, AND NR-11 (Fig. 7).

-- Notigi Reservoir.

In assessing the effectiveness of clearing as a mitigation measure, environmental impacts of clearing have been troublesome unknowns. Quantitative assessments of the time course of shoreline stabilization, the eventual fate of material eroded from shorelines, and suitable management techniques for critical areas are lacking. An experimental clearing program in the Notigi Reservoir has been designed for the purposes of monitoring and assessing environmental changes attributed to clearing.

Details of the program have not been finalized but preliminary sites have been selected. Eleven potential sites have been identified. However, on-site inspection of these sites and preliminary surveying is required. Different clearing techniques will be applied to different shoreline types under different conditions of exposure. Uncleared, "control" sites will also be surveyed, photographed, and monitored. The Freshwater Institute of the Department of Environment Canada has agreed to monitor and assess shoreline recession, offshore sedimentation, nutrient budgeting, and sediment loading and deposition on biological populations.

Knowledge gained from this program will be of considerable importance to future reservoir developments in northern Manitoba as well as northern Canada.

Total costs of the clearing required for this monitoring program have been estimated at $175,000.

SITE UNR-01 (Fig. 1).

-- The Burntwood River from Manasan Falls to the junction of Mystery Creek and the Burntwood River.

The Burntwood River between Manasan Falls and Mystery Creek is used as a recreation area for boating and fishing by the residents of Thompson. It is also used as an access route to other recreation sites such as Mystery Lake and Manasan Falls. Use of this section of the river both as a recreation site and for access to more remote sites, is anticipated to increase as the population of Thompson grows and other sites become crowded.

Flooding along this section will destroy the natural shoreline and will likely make access to the shoreline by boat very difficult. The re-establishment of a natural shoreline could take up to one hundred years. Clearing prior to flooding will hasten the establishment of a natural shoreline and prevent the development of shoreline access problems.

Clearing this section combined with booming the river above Manasan Falls will prevent large quantities of debris floating past Thompson. This is especially important to the operation of the float-plane base directly across from Thompson on the north bank of the Burntwood River. Floating debris can be hazardous to float-plane takeoff and landing.

The vegetation along the Burntwood River between Manasan Falls and Mystery Creek outlet should be cut, piled, and burned to the new high water contour plus two feet. The cost of this clearing is estimated to be $360,000.

SITE UNR-02 (Fig. 1).
-- Mystery Lake.

Mystery Lake is approximately six miles downstream from Thompson on the Burntwood River. It is accessible to the general public only by boat. There is a road from Thompson to Mystery Lake. However, it is owned by INCO and its use is controlled by a series of locked gates. During the winter, INCO supplies the Thompson Ski Club with keys to unlock the first two gates in the series of seven. Members of the ski club use this section of the road to drive to the ski lodge. This is the only public use of the road.

Currently, a few people from Thompson use the lake for boating and fishing. However, as other recreation areas become crowded, use of Mystery Lake is anticipated to increase because it is close to Thompson, has numerous sheltered bays and is scenically attractive.

Flooding of vegetation along the shoreline will destroy the natural beauty of this lake and ruin the recreation potential. Clearing prior to flooding will speed-up the re-establishment of the natural shoreline. Vegetation should be cut, piled, and burned to the new high water level plus two feet. The estimated cost of this clearing is $600,000.

Manitoba Hydro is reviewing a recommendation[2] to isolate Mystery Lake from the Burntwood River by constructing a dam and installing pumping facilities at the lake outlet. If this recommendation is accepted, clearing will not be required.

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[2] *This recommendation was made to Manitoba Hydro by Underwood, McLellan and Associates in the report, "Rat-Burntwood Mitigation Study", Dec. 1973, p.73.*

SUMMARY

The following table and the accompanying map on the following page (see Fig. 1) summarizes the information given in the preceding section.

Table 1 - Additional Sites Recommended for Pre-Flood Clearing

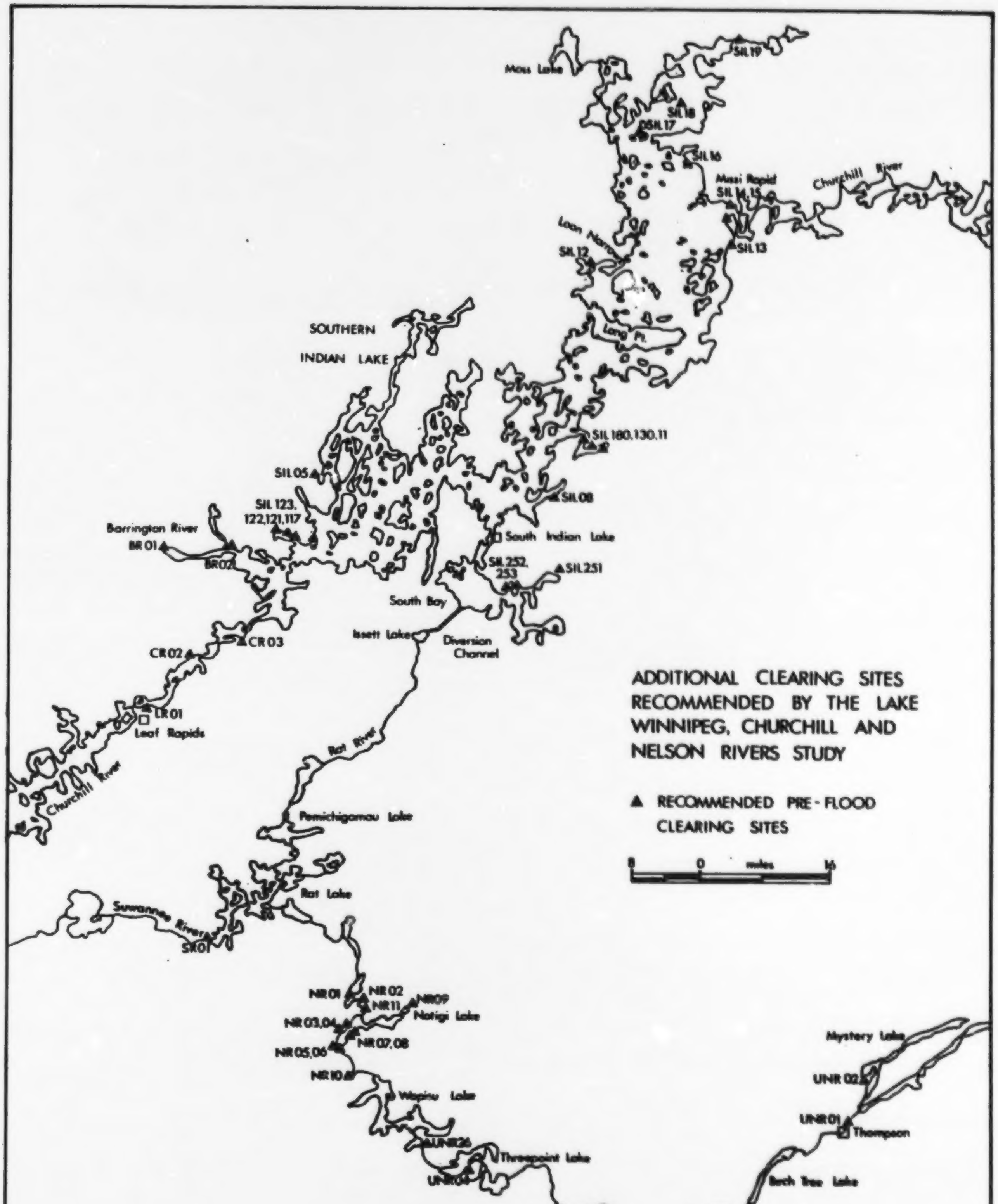
SITE	PURPOSE(S)	ESTIMATED COST/ACRE	NO. OF ACRES	TOTAL COST
LR-01	to enhance the recreation potential.	$ 500	240	$ 120,000
CR-02	to provide suitable walleye spawning sites.	$ 1,500	30	$ 825,000
CR-03		1,500	30	
BR-01		1,500	50	
BR-02		1,500	70	
SIL-08		1,500	50	
SIL-11		1,500	70	
SIL-12		1,500	100	
SIL-19		1,500	150	
SIL-13	to provide suitable nesting sites for terns and gulls.	$ 10,000*	N/A	$ 60,000
SIL-14				
SIL-15				
SIL-16				
SIL-17				
SIL-18				
SIL-117	to prepare sites for archaeological investigations.	$ 2,000	.51	$ 14,000
SIL-122		2,000	.22	
SIL-123		2,000	.22	
SIL-121		2,000	.11	
SIL-252-251		2,000	1.14	
SIL-253		2,000	.25	
SIL-180		2,000	1.51	
SIL-130		2,000	.05	
UNR-26		2,000	.86	
UNR-04		2,000	2.02	
SR-01	to provide suitable walleye spawning sites.	$ 500	750	$ 375,000
NR-01	to monitor environmental impacts of clearing.	$ 350	176[p]	$ 175,000[ƒ]
NR-02		350	224[p]	
NR-03		350	32[p]	
NR-04		350	32[p]	
NR-05		350	16[p]	
NR-06		350	32[p]	
NR-07		350	32[p]	
NR-08		350	48[p]	
NR-09		350	112[p]	
NR-10		350	64[p]	
NR-11		350	160[p]	
UNR-01	to speed-up the re-establishment of a natural shoreline, to prevent the development of shoreline access problems, to eliminate floating debris.	$ 500	720	$ 360,000
UNR-02	to speed-up the re-establishment of a natural shoreline	$ 600	1000	$ 600,000
		TOTAL COST:-		$2,529,000

* - *Estimated cost per site.*

N/A - *Not applicable.*

p - *Potential acreage. It is estimated that these acreages will be reduced by 50% following on-site investigations.*

ƒ - *Estimated maximum total cost of clearing sites identified by on-site inspection.*



ADDITIONAL CLEARING SITES RECOMMENDED BY THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY

FIG. 1

RECOMMENDATIONS

Participants of the Lake Winnipeg, Churchill and Nelson Rivers Study recommend the following pre-flood timber clearing as measures to mitigate the effects of flooding resulting from the diversion of the Churchill River. These recommendations have not been endorsed by the Study Board.

1. Vegetation along the inlet immediately downstream of Leaf Rapids on the south side of the Churchill River should be cut, piled, and burned; and the area grubbed to the high water level plus two feet. Total cost of this clearing is estimated to be $120,000.

2. Vegetation along the rivers (specified in the previous section) entering Opachuanau Lake and Churchill River should be cut, piled, and burned to the new high water level plus two feet freeboard. Rivers entering Southern Indian Lake should be cleared from 100 yards downstream of the foot of the present rapids, upstream to the point where the new high water contour plus two feet intersects the rivers. Total cost of this clearing is estimated to be $825,000.

3. Trees and large shrubs should be cut, uprooted and burned above the floodline on six islands in the northern section of Southern Indian Lake near Missi Rapid. Prior to clearing, all potential islands identified should be inspected by a biologist to determine the best sites and the extent of clearing. Estimated cost of this clearing is $60,000.

4. Trees should be hand cut one foot above ground level at archaeological excavation sites on Southern Indian Lake and along the Burntwood River.

The slash should be piled and burned, and the large logs decked. An archaeologist should supervise the clearing program. Total cost is estimated to be $14,000.

5. Vegetation along the Suwannee River should be cut, piled, and burned from the intersection of the new high water contour and the river, downstream to where it presently enters Rat Lake. Estimated total cost is $375,000.

6. Monitoring sites on Notigi Lake and the Rat River should be cleared using a variety of techniques as outlined in the preceding section. Estimated total cost is $175,000.

7. Vegetation along the Burntwood River from Manasan River to the junction of Mystery Creek and the Burntwood River, should be cleared to the new high water level plus two feet freeboard. The total cost of this clearing is estimated to be $360,000.

8. Vegetation along the shoreline of Mystery Lake should be cut, piled, and burned to the new high water level plus two feet freeboard. Total cost is estimated to be $600,000.

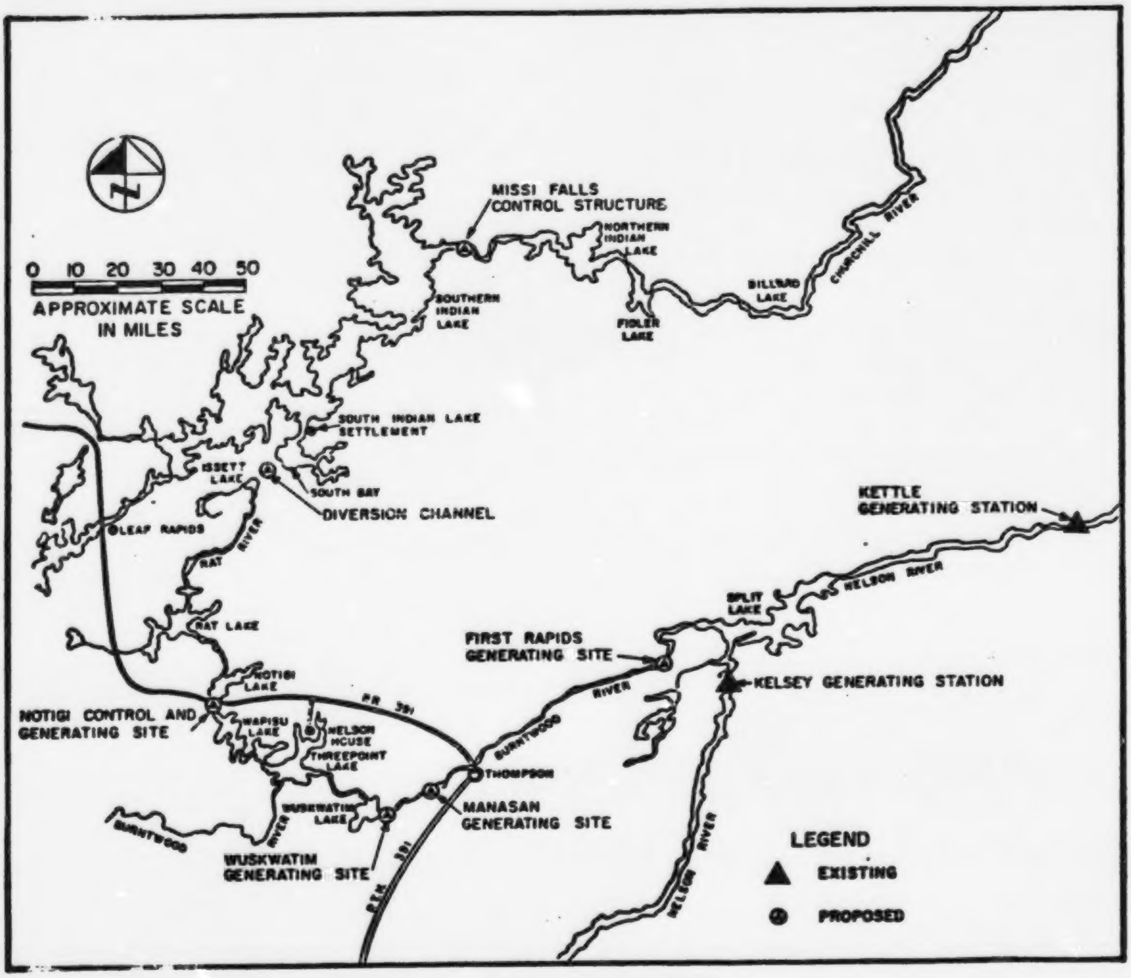


FIG.2. CHURCHILL RIVER DIVERSION.

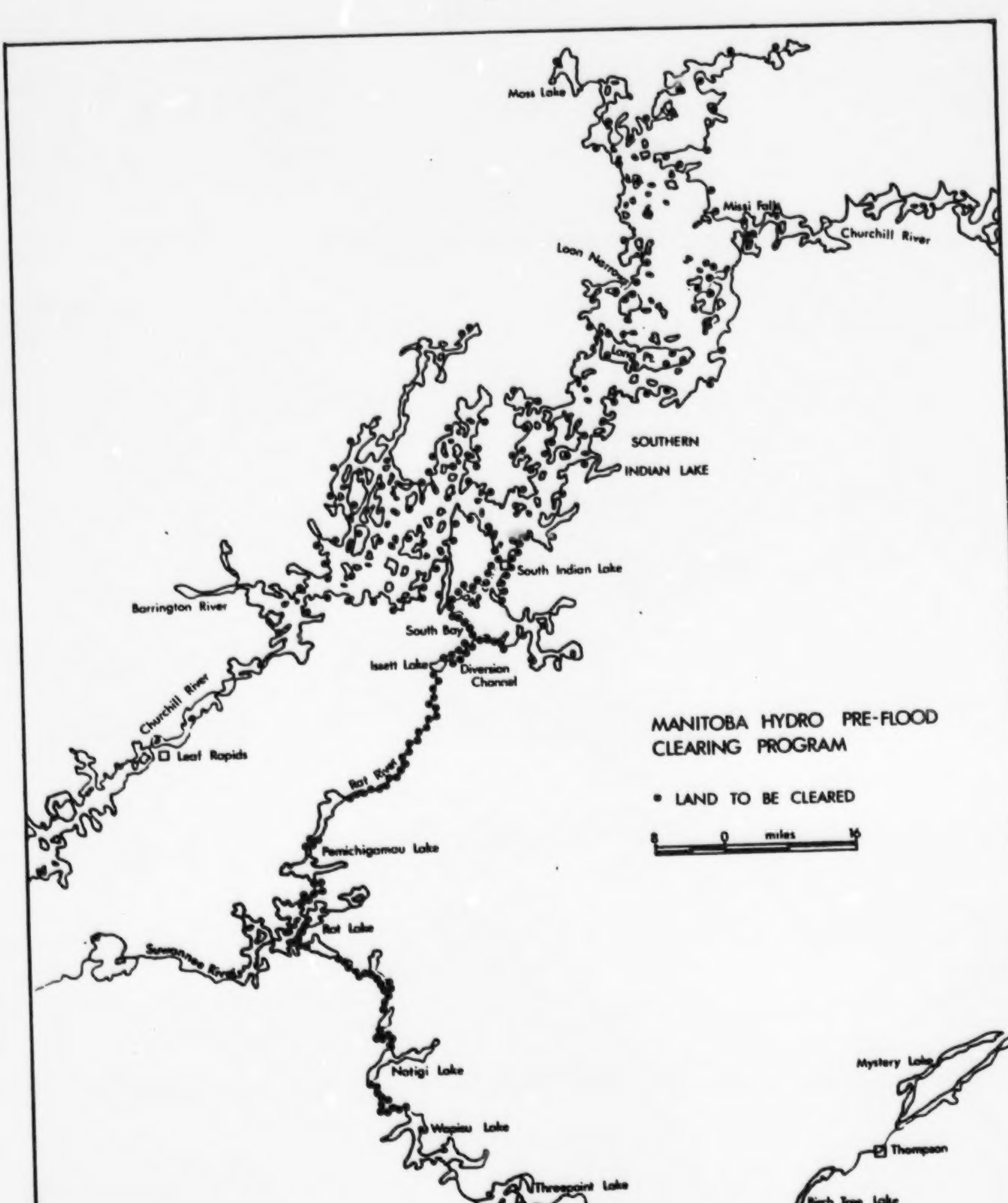
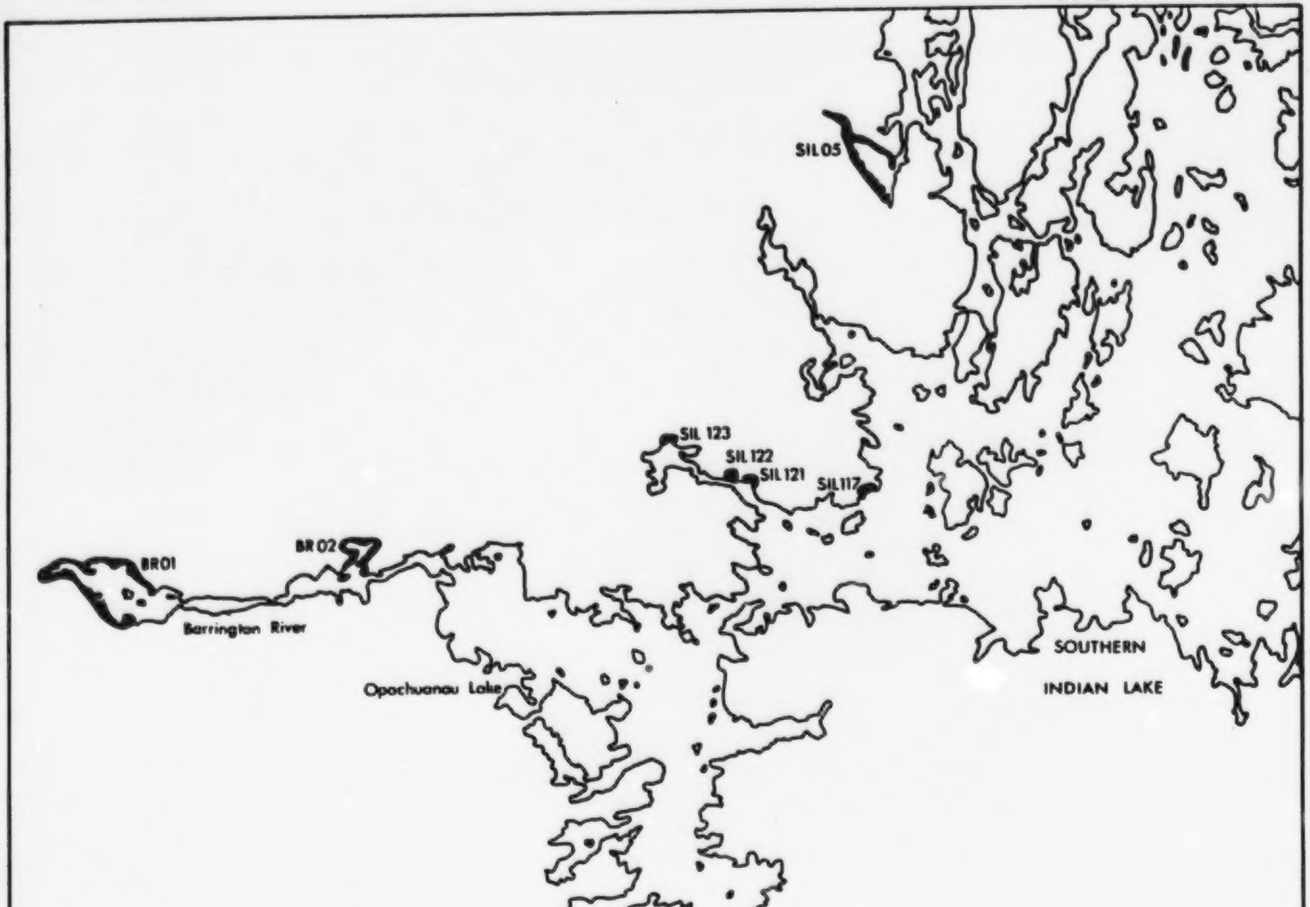
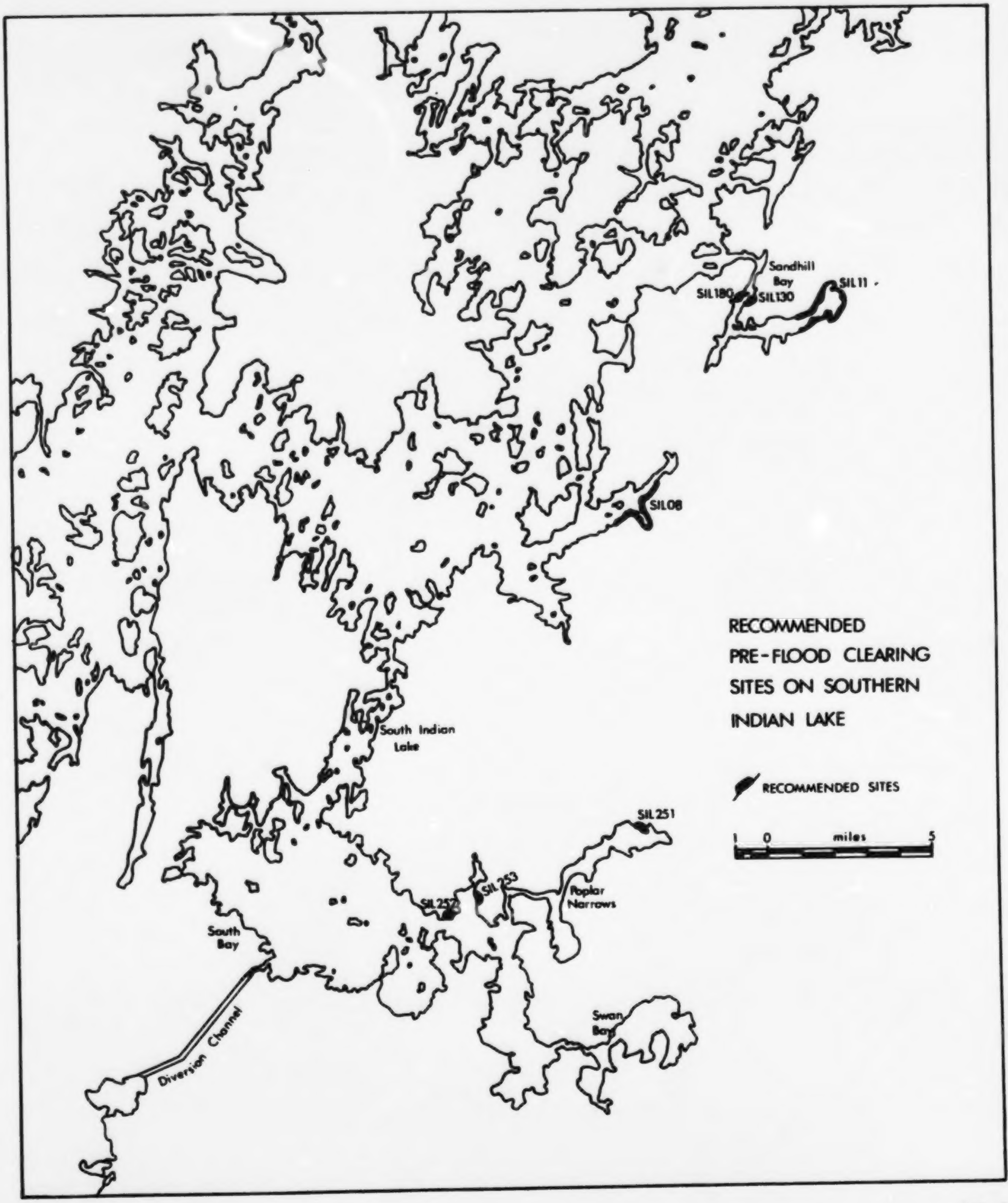

Moss Lake
Missi Falls
Churchill River
Loon Narrows
Long Pt.
SOUTHERN
INDIAN LAKE
South Indian Lake
Barrington River
South Bay
Issett Lake
Diversion
Channel
Churchill River
Leaf Rapids
MANITOBA HYDRO PRE-FLOOD
CLEARING PROGRAM
• LAND TO BE CLEARED
8 0 miles 16
Rat River
Pemichigamau Lake
Rat Lake
Suwannee River
Notigi Lake
Wapisu Lake
Threepoint Lake
Wuskwatim Lake
Burntwood River
Birch Tree Lake
Thompson
Mystery Lake

FIG. 3



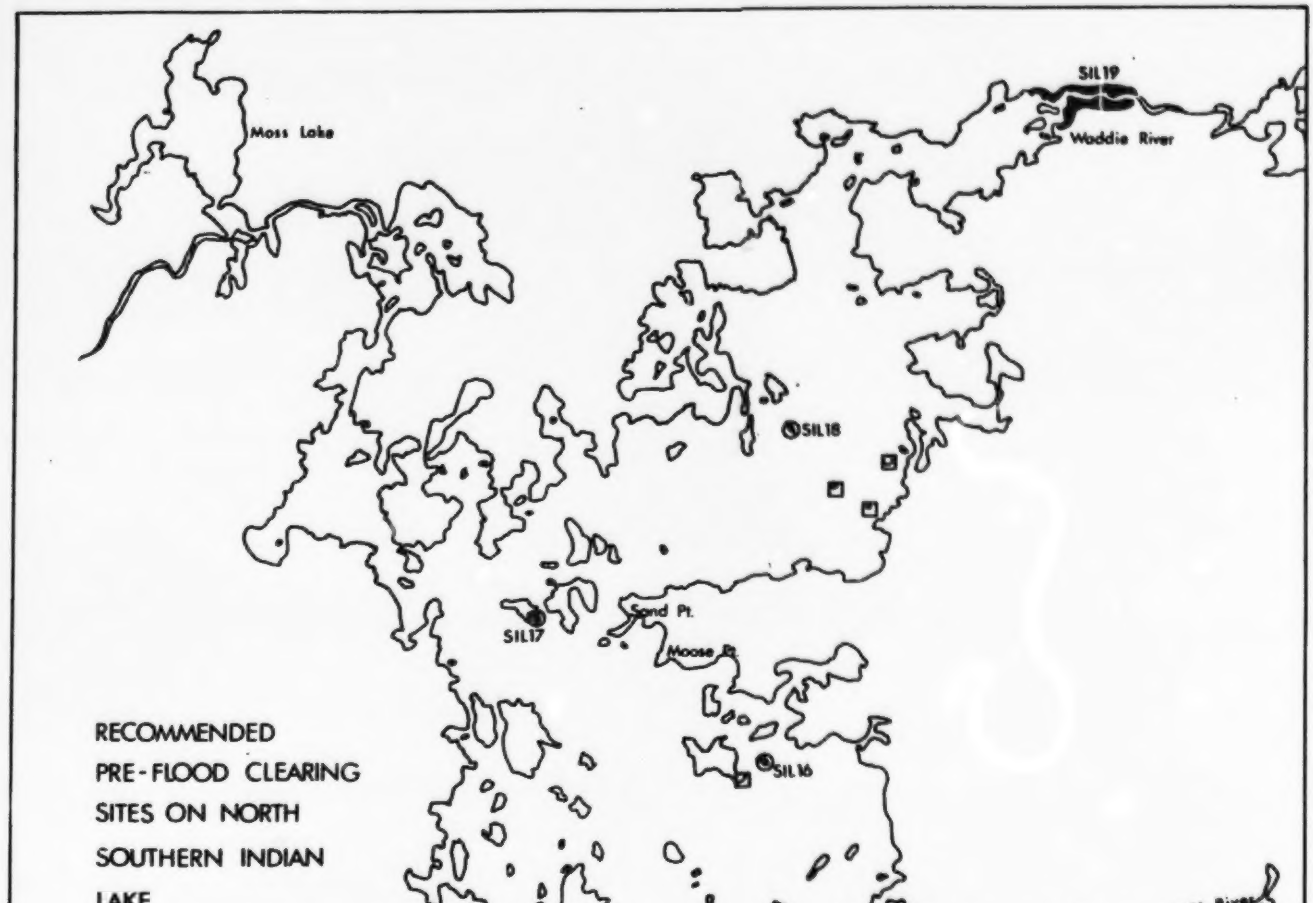
RECOMMENDED PRE-FLOOD CLEARING SITES ON THE CHURCHILL RIVER

FIG. 4



RECOMMENDED PRE-FLOOD CLEARING SITES ON SOUTHERN INDIAN LAKE

FIG. 5



RECOMMENDED PRE-FLOOD CLEARING SITES ON NORTH SOUTHERN INDIAN LAKE

FIG. 6

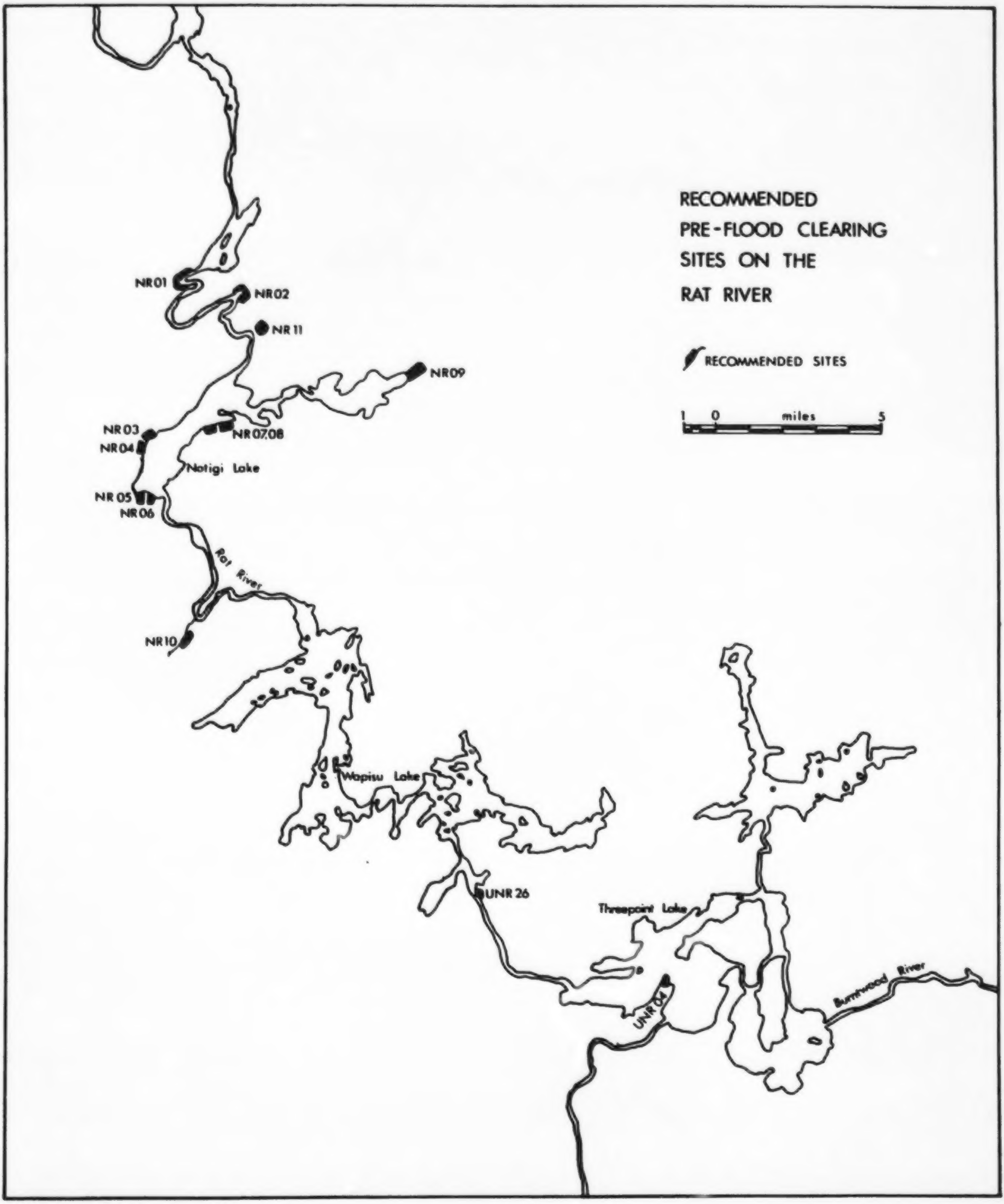

RECOMMENDED PRE-FLOOD CLEARING SITES ON THE RAT RIVER
RECOMMENDED SITES
1 0 miles 5
NR01
NR02
NR11
NR09
NR03
NR04
NR07,08
Notigi Lake
NR05
NR06
Rat River
NR10
Wapisu Lake
UNR 26
Threepoint Lake
UNR 04
Burntwood River

FIG. 7

APPENDIX 1 - R

ADDITIONAL RECOMMENDATIONS OF STUDY PARTICIPANTS FOR PRE-FLOOD CLEARING ON SOUTHERN INDIAN LAKE AND THE DIVERSION ROUTE

ADDITIONAL
RECOMMENDATIONS OF STUDY PARTICIPANTS
FOR PRE-FLOOD CLEARING ON
SOUTHERN INDIAN LAKE AND THE DIVERSION ROUTE

by

B. NOWICKI
Lake Winnipeg, Churchill and Nelson Rivers Study Office
Winnipeg, Manitoba
April, 1974

for

THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

SPECIAL NOTE

THE CONCLUSIONS AND RECOMMENDATIONS CONTAINED IN THIS APPENDIX ARE THOSE OF THE AUTHOR(S) AND ARE NOT NECESSARILY THE SAME AS THE CONCLUSIONS AND RECOMMENDATIONS OF THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD AS EXPRESSED IN THE SUMMARY REPORT AND THE TECHNICAL REPORT.

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INTRODUCTION

Since the writing of the report entitled "Recommendations of Study Participants for Pre-Flood Clearing on Southern Indian Lake and the Diversion Route (April 11, 1974)", additional sites have been identified and recommended by participants for pre-flood clearing. This report describes these sites and should be considered as an attachment to the first report. As with the previous report, the pre-flood clearing recommendations contained in this report have been compiled in the Study Office and have not been endorsed by the Board.

ADDITIONAL SITES RECOMMENDED FOR PRE-FLOOD CLEARING

SITE SIL-04

-- A portage used by fishermen as a short route from Jumbo Bay to Loon Narrows.

On the northern shore of Southern Indian Lake a portage connects a bay locally known as Jumbo Bay to a small creek which flows into another bay on Southern Indian Lake (see Fig. 2). Jumbo Bay is heavily utilized for commercial fishing in the summer. In 1973, over 20,000 lbs. of fish were taken from this bay. During the summer, many fishermen travel from Jumbo Bay to Loon Narrows and some use the portage mentioned above as a shorter route. This travel pattern is not anticipated to change after diversion.

After diversion this portage will be flooded and water levels in the creek will be approximately 10 feet higher. It is anticipated that water levels above the portage will be deep enough to permit the passage of boats. Clearing and burning the vegetation along the portage and creek to the 850-foot contour, or 500 feet along both sides whichever is less, should ensure that boats can be safely navigated through this portage.

SITES SIL-03 AND SIL-09 (Fig. 1).

-- Camp 3 and Camp 9 respectively on Southern Indian Lake.

Camp 3 and Camp 9 are operated by the South Indian Lake Fisheries Co-op. During the summer fishermen and their families follow a traditional fishing pattern moving from Camp 3 to Camp 9 and finally to Loon Narrows. Usually, the fishing season opens on June 1 at either Camp 3 or Opachuanau Lake. Around July 1, they move to Camp 9 and from there to Loon Narrows. Closing of Camp 3 and Camp 9 is dependent on the amount of ice available for storing their catch in the ice houses.

After diversion, the location of fishing grounds is not anticipated to change and annual use of Camp 3 and Camp 9 is expected to remain high, if these sites are cleared prior to flooding.

Camp 3 and Camp 9 are slated for pre-flood clearing under a program funded by Manitoba Hydro. The program is to ensure that landing sites will be available on Southern Indian Lake after diversion. One-half acre of vegetation is to be cut, piled, and burned at each site. Study participants estimated that while this would be of sufficient size for a landing site, it is not large enough for a fish camp. At both Camp 3 and Camp 9, vegetation should be cut, piled, and burned to the anticipated high water level plus two feet, or 500 feet horizontally whichever is less, for one mile on both sides of the existing camp facilities.

Talks are underway between Manitoba Hydro and the South Indian Lake Fisheries Co-op concerning the relocation of Camp 3. Camp 3 is not sheltered from storms and a superior site in terms of protection exists just south of the present location. In addition, ice houses were constructed at this more southerly site last year. If Camp 3 is relocated, Study participants recommend that the scheduled clearing of 1/2 acre at the original site of Camp 3 be pursued rather than the suggested clearing of two miles of shoreline. However, in addition to this, vegetation should be cut, piled, and burned to the anticipated high water level plus two feet, or 500 feet horizontally whichever is less, for one mile on both sides of the ice houses at the new location.

RECOMMENDATIONS

Participants of the Lake Winnipeg, Churchill and Nelson Rivers Study recommend the following pre-flood clearing in addition to the recommendations made in the previous report entitled, "Recommendations of Study Participants for Pre-Flood Clearing on Southern Indian Lake and the Diversion Route". These recommendations have not been endorsed by the Study Board.

1. Vegetation along the portage and creek shown on figure 2 as SIL-03, should be cut, piled, and burned to the 850-foot contour or to 500 feet along both sides whichever is less.

2. Vegetation along the shoreline at fish camp 9 should be cut, piled, and burned to approximately 1 mile on both sides of the existing camp.

3. Vegetation along the shoreline at fish camp 3 should be cut, piled, and burned to approximately 1 mile on both sides of existing camp facilities.

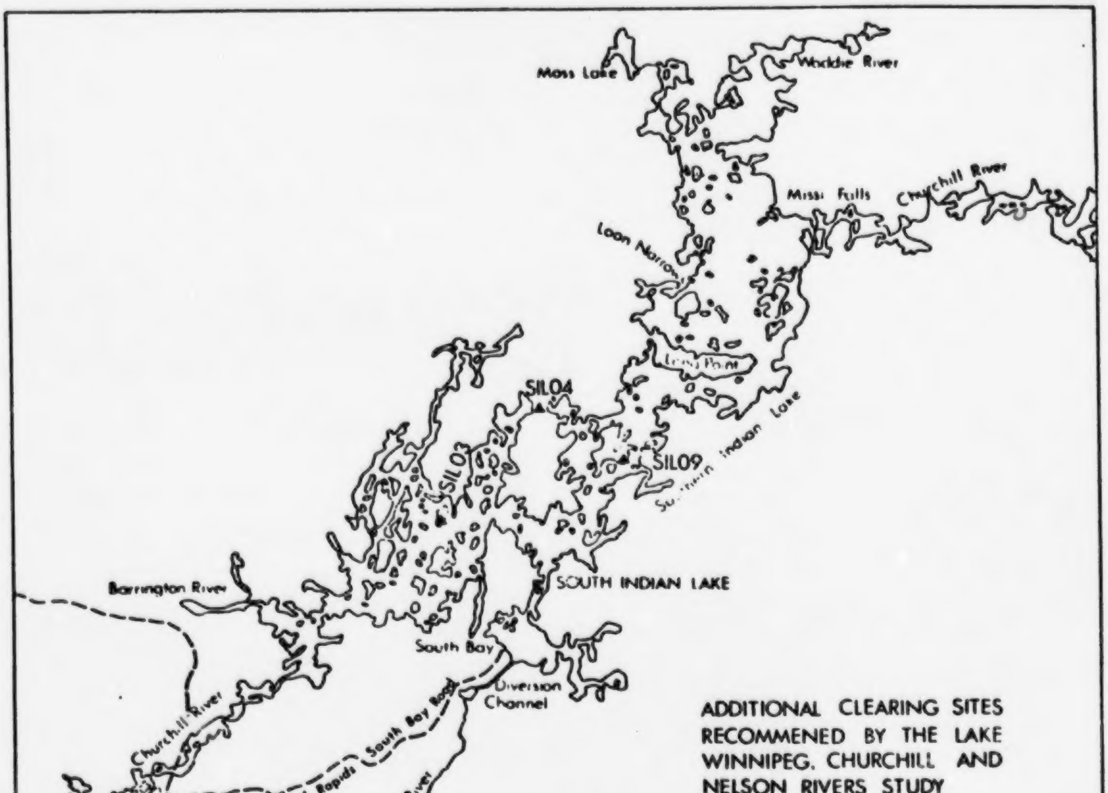

FIG. 1 ADDITIONAL CLEARING SITES

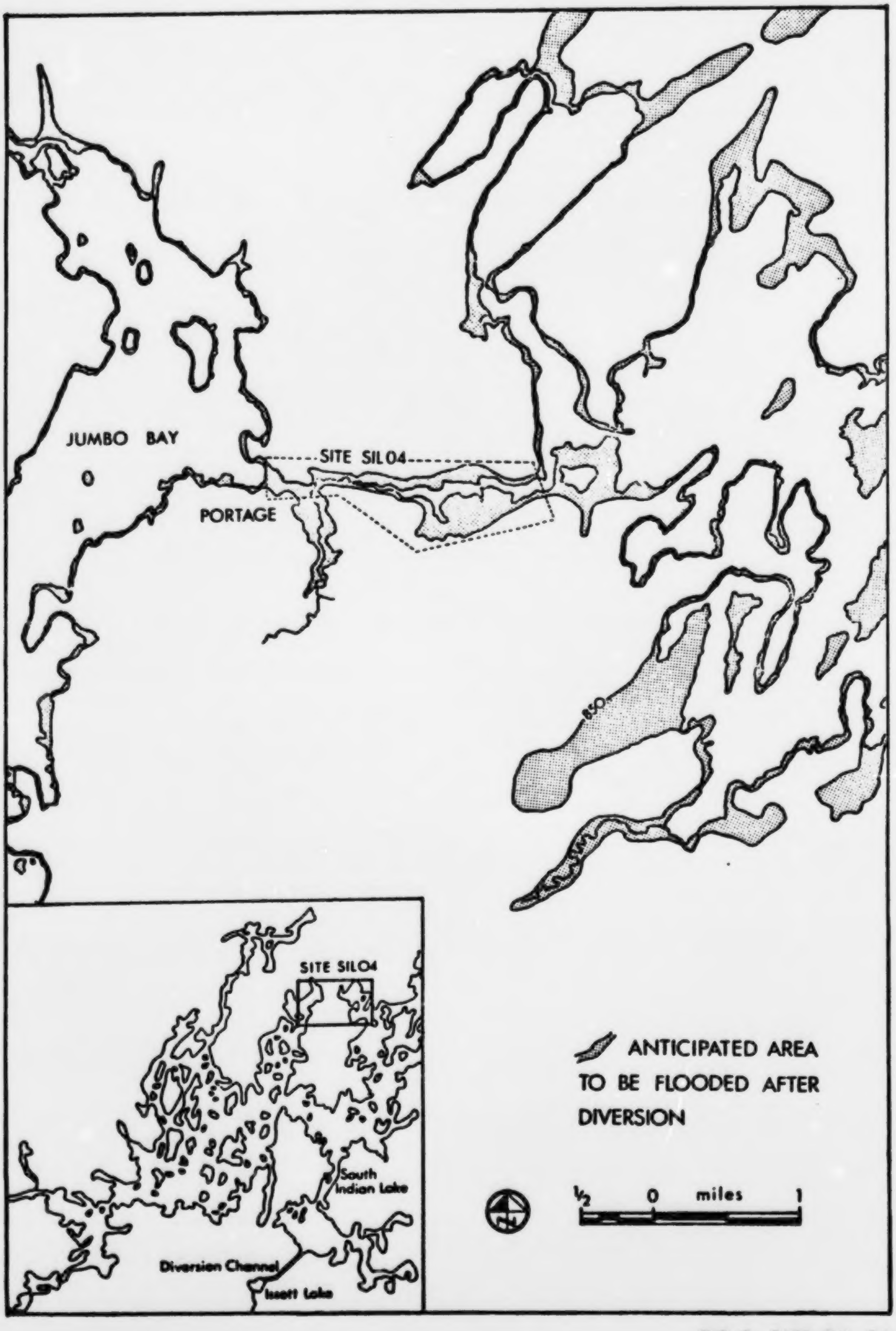

FIG. 2 SITE SIL 04

APPENDIX 1 - S

ASSESSMENT OF THE IMPACT OF THE CHURCHILL RIVER DIVERSION ON THE CHURCHILL RIVER ESTUARY AREA

ASSESSMENT OF THE IMPACT OF THE CHURCHILL RIVER DIVERSION ON THE CHURCHILL RIVER ESTUARY AREA

by

Lake Winnipeg, Churchill and Nelson Rivers Study Board
Winnipeg, Manitoba
April, 1974

CANADA - MANITOBA

LAKE WINNIPEG, CHURCHILL and

NELSON RIVERS STUDY BOARD

693 TAYLOR AVENUE WINNIPEG R3M 2K2

April 22, 1974.

The Honourable Jack Davis,
Minister, Environment Canada,
OTTAWA, Canada.

The Honourable Sidney Green, Q.C.,
Minister, Manitoba Department of Mines,
Resources and Environmental Management,
WINNIPEG, Manitoba.

Mr. L. A. Bateman, P. Eng.,
Chairman, Manitoba Hydro,
WINNIPEG, Manitoba.

Gentlemen:

The Lake Winnipeg, Churchill and Nelson Rivers Study Board has undertaken an assessment of the impact of the Churchill River diversion on the Churchill River estuary area. The reduced flows in the estuary area resulting from the Churchill River diversion could cause problems related to the Town of Churchill's water supply, to wildlife in the area, and to navigation between the estuary and the junction of the Churchill River and the Deer River. However, because of the time and money constraints of the Study Agreement, the Board cannot undertake the detailed studies which are required. Since flow reductions in the lower Churchill River may occur as early as February, 1975, immediate attention should be given by the appropriate federal and provincial government agencies to the resulting low flows in the estuary area and the problems arising therefrom.

CHURCHILL WATER SUPPLY SYSTEM

The Town of Churchill obtains its domestic water supply from the Churchill River. Since the early 1960's the water intake pipe has been located on the Churchill River just upstream of its confluence with Goose Creek (see Fig. 1). The intake pipe conveys water to a pumphouse where it is heated and then pumped to a reservoir in the town. There the water is reheated and pumped to consumers.

With reduced flows and water levels, it appears that the water intake pipe is not deep enough to avoid being damaged by ice formation and movements. In addition, reduced flows and levels may shift the zone of tidal influence as far upstream as the intake pipe for short periods of time throughout the year. Intrusion of salt water will not only corrode the intake pipe, it will also make the water unsuitable for human consumption.

WILDLIFE IN THE CHURCHILL RIVER ESTUARY

Control of the Churchill River at Missi Falls will reduce the average historic fall flows of the lower Churchill River by approximately 40%. The lower flows could delay the accumulation of ice pans along the Hudson Bay coastline in the Cape Churchill area. The ice pans are generated by the fresh water from the Churchill River. Towards fall, polar bears move up the Hudson Bay coastline to the Cape Churchill area awaiting the accumulation of these ice pans and the chance to get back on the bay to hunt seal. Cape Churchill is approximately 30 to 40 miles from the Churchill townsite and the bears in past years have been attracted to the town during the period when they are waiting to get on the ice and have been a nuisance to the townspeople. Any delay in the development of ice on the bay could aggravate this situation.

Changes in the date of freeze up and break up, combined with changes in the zone of tidal influence, could alter the type and abundance of plants in the estuary. Changes in vegetation communities may affect beluga whales, muskrats, and waterfowl which inhabit the estuary. Beluga whales, which usually move into the estuary in the fall, may seek alternative sites. Muskrats, which are trapped on a limited basis in the estuary, may decrease in abundance. A small population of waterfowl which usually spends the late summer feeding in the estuary may move farther upstream.

NAVIGATION PATTERNS BETWEEN THE ESTUARY AND
THE JUNCTION OF CHURCHILL RIVER AND DEER RIVER.

Use of the lower Churchill River for navigation is limited to recreational traffic. It is not used for commercial transportation. The lower Churchill River between the junction of Deer River and the estuary (see Fig. 1) is utilized for fishing, boating, and as a transportation route to cottages and cabins.

Sport fishing, particularly for grayling, is popular along Goose Creek and other tributaries entering the lower Churchill River. Although the river is shallow in spots, boats can travel about sixty miles upstream from the estuary. Cottages are spread along the lower Churchill River but there is a concentration in the Goose Creek area. These cottages are owned by residents of the Town of Churchill. Generally, residents travel by road to a marina at Goose Creek where boats and canoes are stored, and then travel by boat to their cottages.

Use of the river for recreation by non-residents is limited, Approximately six parties annually canoe down the Deer River to the lower Churchill River.

The lower Churchill River, as previously mentioned, is very shallow in spots and recreationists frequently have to pull their boats over these shallow sections. With controlled outflows, levels will be reduced and navigation will be made more difficult.

RECOMMENDED ACTION

Manitoba Hydro plans to begin impoundment on Southern Indian Lake in June, 1975, but could start as early as February, 1975, if abnormally low summer flows are forecast for the Churchill River. Therefore the Board recommends that studies be undertaken immediately to determine what measure or measures would best meet the water supply needs of the Town of Churchill and would, at the same time, mitigate adverse effects of the Churchill River diversion on wildlife and navigation in the estuary area. Two possible measures have been suggested to the Board.

1. A weir in the river channel in the vicinity [illegible] osquito Point (see Fig. 1) would prevent salt water fr[illegible] to the water intake and could allow adequate water levels [illegible]stained upstream.
2. Water could be pumped from the existing water intake to a nearby lake during the summer months. This lake would serve as a reservoir for the Town of Churchill's water supply during the winter and other low flow periods.

The Board suggests that the appropriate government agencies which would be concerned with the problems discussed herein are:

1. Provincial agencies
    - Manitoba Hydro
    - Department of Mines, Resources & Environmental Management
    - Department of Tourism, Recreation & Cultural Affairs
    - Department of Northern Affairs
2. Federal agencies
    - Department of the Environment
    - Department of Indian Affairs & Northern Development
    - Ministry of Transport
    - Canadian Wildlife Service

Yours truly,

N. Mudry, P. Eng.,
Chairman

b.c. Mr. N. H. James
Mr. E. W. Humphrys
Dr. J. R. Vallentyne
Mr. J. T. Cawley
Mr. C. J. Goodwin
Mr. J. Gibb
Mr. W. C. McLean
Mr. A. S. Murray
Mr. Monty Samson
Mr. D. G. Ramsey

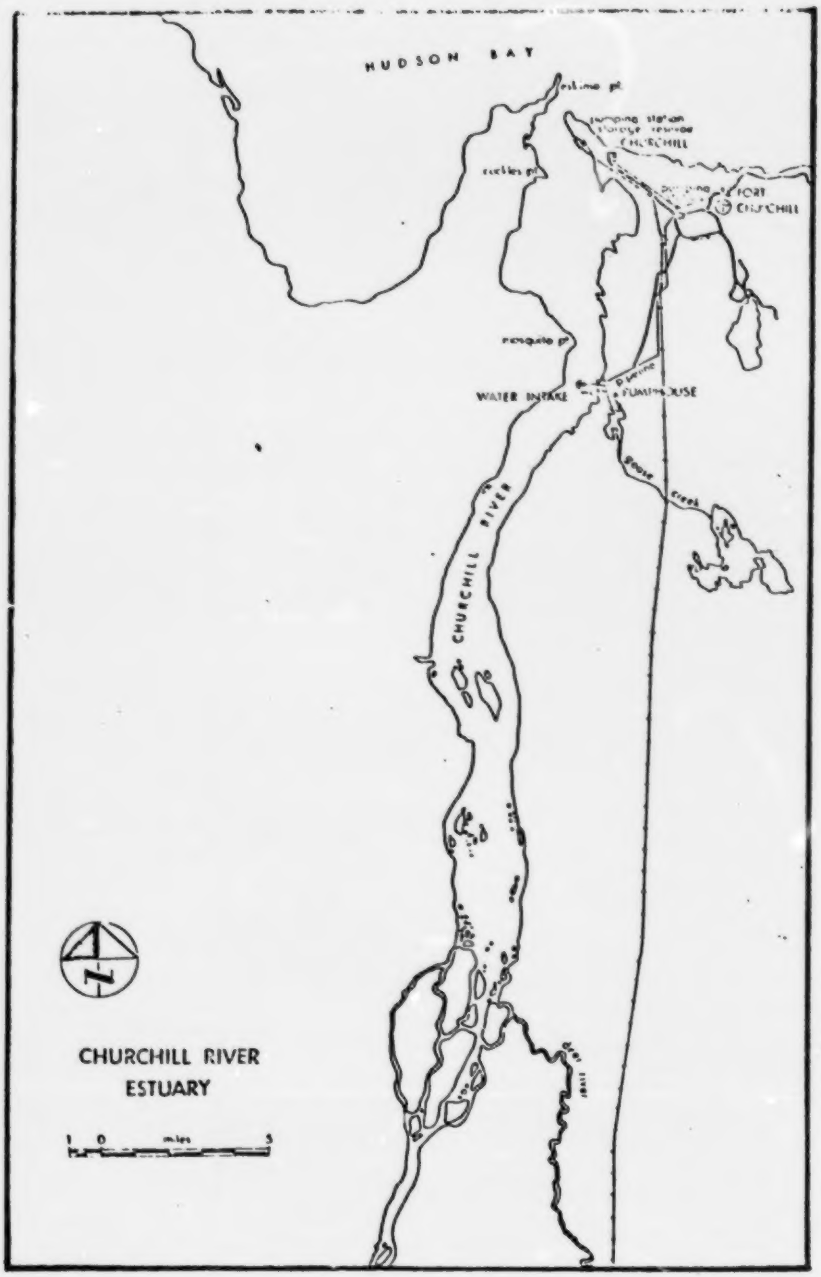
HUDSON BAY
eskimo pt
pumping station
storage reservoir
CHURCHILL
cockles pt
pumping
FORT CHURCHILL
mosquito pt
pipeline
WATER INTAKE
PUMPHOUSE
goose creek
CHURCHILL RIVER
CHURCHILL RIVER ESTUARY
1 0 miles 5

FIG. 1

APPENDIX 1 - T

POSSIBILITY OF A ONE YEAR DELAY IN RAISING THE LEVEL OF SOUTHERN INDIAN LAKE

POSSIBILITY OF A ONE YEAR DELAY IN RAISING THE LEVEL OF SOUTHERN INDIAN LAKE

by

Lake Winnipeg, Churchill and Nelson Rivers Study Board
Winnipeg, Manitoba
November, 1974

CANADA - MANITOBA

LAKE WINNIPEG, CHURCHILL and

NELSON RIVERS STUDY BOARD

693 TAYLOR AVENUE WINNIPEG R3M 2K2

November 6, 1974.

The Honourable Jeanne Sauve,
Minister, Environment Canada,
OTTAWA, Ontario.

The Honourable Sidney Green, Q.C.,
Minister, Manitoba Department of Mines,
Resources and Environmental Management,
WINNIPEG, Manitoba.

Mr. L. A. Bateman, P. Eng.,
Chairman, Manitoba Hydro,
WINNIPEG, Manitoba.

Madame and Sirs:

The Study Board learned recently that, due to excellent water supply conditions in the Lake Winnipeg system, it is unlikely that the Churchill River Diversion project will have to be operated at full design capacity until November 1976. The original plan called for the level of Southern Indian Lake to be raised to elevation 847 feet, approximately five feet above the present level, and for up to 30,000 cubic feet per second (cfs) to be diverted in November 1975. The revised plan provides for Southern Indian Lake to be maintained at about its present level until July 1976 following which it will be raised to elevation 847 feet by November 1976. The rate of flow in the Diversion route will be stepped up from approximately 10,000 cfs in November 1975 to 30,000 cfs in November 1976.

The possibility of a one year delay in raising the level of Southern Indian Lake and stepping up the diversion flow rates during the first year of operation creates opportunities for an extension of certain activities and studies. The Study Board recommends that appropriate government agencies be made aware of the information contained in this letter.

Yours truly,

N. Mudry, P. Eng.,
Chairman.

LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

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